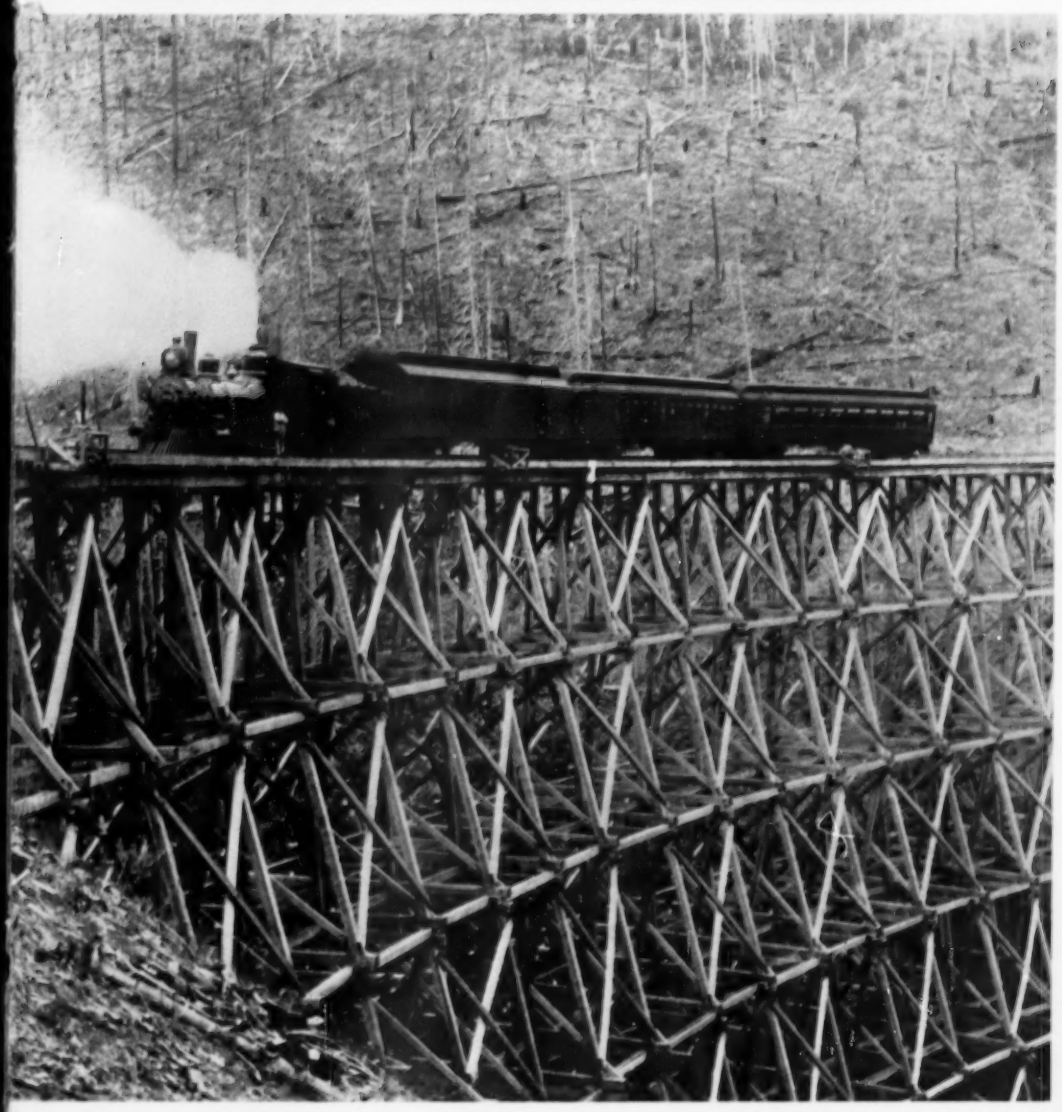
Compressed Air Magazine

JULY 1957



PHOTO, NORTHERN PACIFIC RAILROAD

RAILROAD RELICS
OF A BYGONE DAY
Old Photo Recalls Days
Of Wooden Trestles,
Steam Engines

(SEE INDEX PAGE)

VOLUME 62 • NUMBER 7 NEW YORK • LONDON

COPPUS "BLUE RIBBON" VENTILATORS

Used in wide variety of applications throughout industry

Improve workers' safety . . . health . . . comfort . . . efficiency

VANO DESIGN "A" VENTILATOR is used here during repairs to a chemical still. This type ventilator is used to ventilate tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages and other confined places. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "B" VENTILATOR here discharges welding fumes from double-bottom compartment in naval vessel under construction. Large volume of air handled quickly expels fumes and results in good ventilation. Vano Design "B" can pass through opening only 14" in diameter. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR here withdraws fumes from a reactor kettle. This ventilator can be furnished with 8" suction inlet for 8" non-collapsible suction tubing — or multiple inlet nozzles for 5", 4", and 3" suction hose. The discharge may be connected to 8" "Ventube." Capacities furnished on request.

NO. 2 AEROPLANE HEAT KILLER here directs cool, fresh air on worker in drop forge plant. Heat killers restore workers' efficiency by providing extra ventilation in the hot months, or on any job where workers are continually or periodically required to work in excessive heat. Available in two types, three sizes in each.

VENTAIR DESIGN TE-4 VENTILATOR Gasoline Engine Driven, here delivers air into underground manhole. These ventilators provide fresh air to men in confined places, promoting safety, comfort, and increasing efficiency. Ideal where no electric current is available. Delivers 1700 CFM of fresh air. Uses 8" diameter flexible canvas tubing ("Ventube").

PORTAIR NO. 4 BLOWER EXHAUSTER exhausts fumes resulting from soldering, welding, tank coating, is also used in ventilating small tanks. It is designed to permit attachment of 4" flexible metal hose. Capacity: 425 CFM free air.

ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION, 207 PARK AVENUE, WORCESTER 2, MASS. Sales offices in Thomas' Register. Other "Blue Ribbon" Products in Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory and Mining Catalogs.

Please send me information on supplying fresh air to men working:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens
- ☐ on steam-heated rubber processes
- ☐ on boiler repair jobs

COOLING:

- ☐ motors, generators, switchboards
- ☐ wires and sheets
- ☐ general man cooling
- ☐ around cracking stills
- ☐ exhausting welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying
- ☐ drying of walls, sheets, etc., after treated with coating material

Name .....

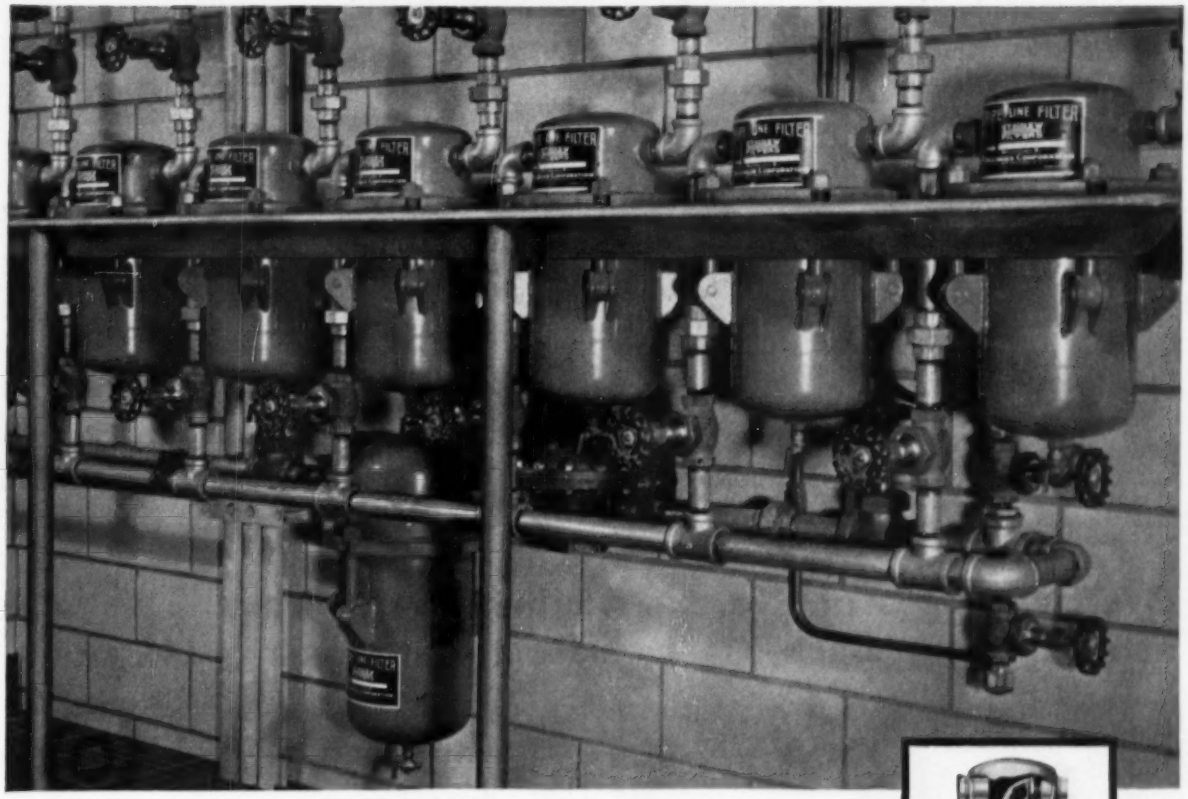
Company .....

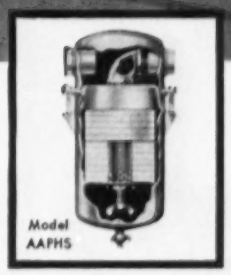
Address .....

City .....Zone....State.....

Write here any special ventilating problem you may have { _____ _____

Circle 1A on reply card





RG&E Standardizes with Staynew Filters

Successful Staynew filter applications abound at Russell electrical station of the Rochester Gas & Electric Corporation.

When Russell opened in 1949, the utility specified Staynew absorption filters, Model AAPHS, for supply air to its automatic boiler controls after coke and then charcoal filters had failed.

The substitution proved so satisfactory that as RG&E expanded new Staynew Filters were installed.

Each bank of eight filters is inspected only once a year. Every *other* year, filter elements are dry-cleaned for re-use.

In another filter application, air taken into the utility's four large carbon-ring compressors is filtered in each instance by a Staynew Model DS250 B4 air-intake filter.

A third filter application is the use of a Staynew Model DS350 B5 on each of four other compressors whose output removes soot from boiler walls and keeps slag off arches and passes. On two additional compressors, also used for soot-blowing operations, two larger Staynew filters, Model DS825 B8, are installed.

The final filter application is on a Worthington compressor for house service.

Most of these filters have been installed for years. All of them have a noteworthy record of performance.

Standardize on Staynew filters, as RG&E has done, for all your filter needs. Write today for Pipe Line Filter Bulletin 200. Dollinger Corporation, 7 Centre Park, Rochester, N. Y.

PROTECTOMOTOR

STAYNEW FILTERS

DOLLINGER

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

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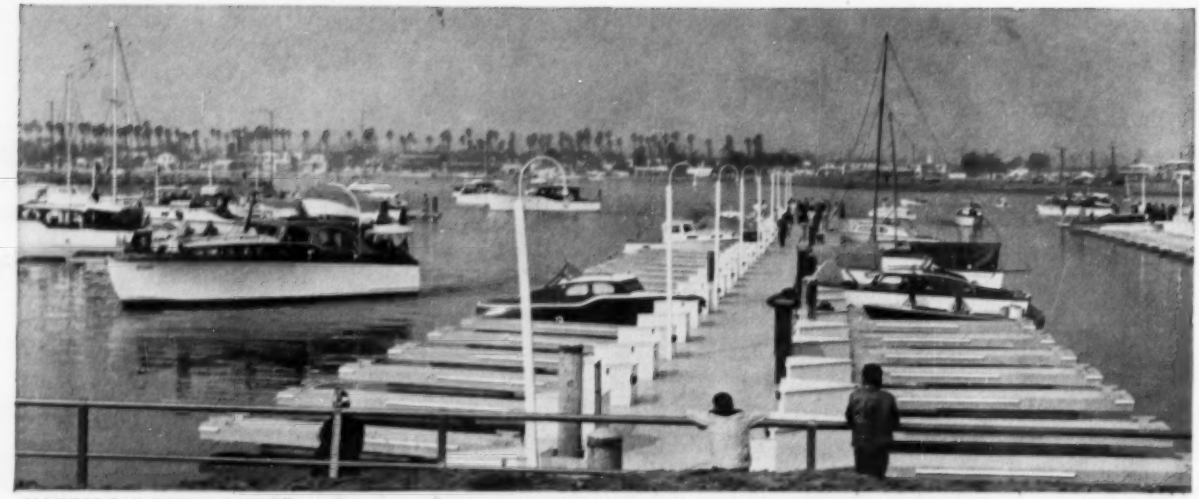

ALAMITOS BAY MARINA BASIN #1, built by the City of Long Beach, Calif: S. E. Vickers, city manager; J. D. Gilkerson, city engineer; B. E. McCune, deputy city engineer; Thomas G. Marchese, project engineer. Engineers: Moffatt & Nichol Inc., Long Beach. Electrical contractor: Ets-Hokin & Galvan, Wilmington, Calif. Everdur Conduit furnished by General Electric Supply Company, Long Beach, Calif.

Over two miles of Everdur Conduit guards electric service at new Long Beach, Calif., marina unit, serving 342 boats

EVERDUR ELECTRICAL CONDUIT is installed under floating docks, only inches above the water. Plug-in electrical outlets are located at lockers by each slip and on lighting standards. *Below:* Everdur Electrical Conduit is available in two wall thicknesses—R. C. and E. M. T.

PHOTOS COURTESY INDEPENDENT-PRESS-TELEGRAM, LONG BEACH, CALIF.

The City of Long Beach, Calif., is in the process of transforming its Alamitos Bay area from tide flats and a massive mosquito factory into one of the finest small boat harbors in the world.

The first boat basin and marina unit, which can accommodate 342 boats, is now complete. The floating docks are well lighted and at each slip, boat owners have plug-in electric service and a fresh water tap. All electrical wiring from the shore out is protected by Everdur® Electrical Conduit — well over 11,000 feet, ranging from ½″ nominal size to 3″. In addition, all fittings and boxes are of Everdur.

Everdur Electrical Conduit — made from one of Anaconda's copper-silicon alloys—never rusts and offers high resistance to other types of corrosion. It provides dependable year-after-year protection wherever water and corrosive atmospheres are a problem — or where conduit must be buried or embedded in concrete. Everdur is also tough — it stands up under movement and vibration.

For detailed information, write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

57136A

EVERDUR
ELECTRICAL CONDUIT

an ANACONDA® product
made by The American Brass Company

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

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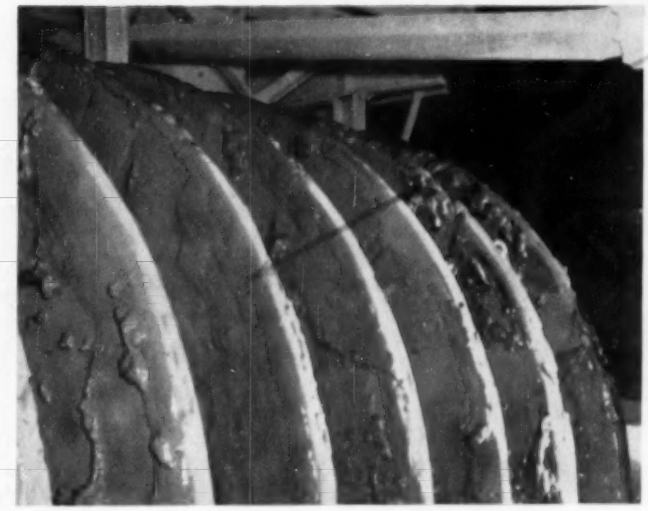
If Your Filter Cakes Look Like **THIS**



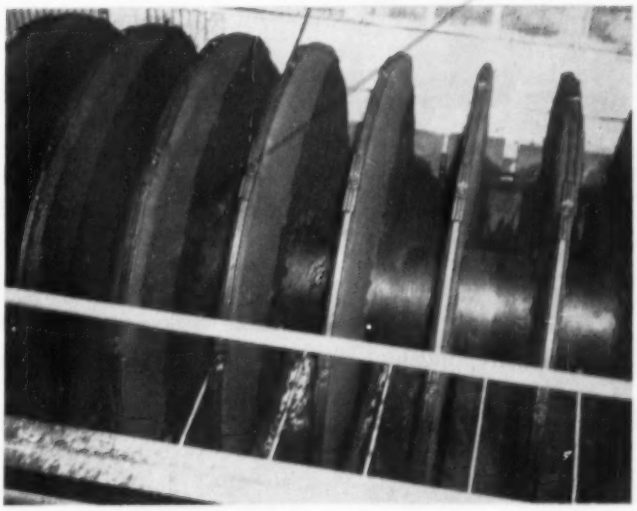
FROM IMPROPER AGITATION

Thin, slimy, uneven cakes exhibited by these discs result in LOW PRODUCTION, HIGH MOISTURE AND EXCESSIVE BAG COSTS. The main evil? IMPROPER AGITATION!

YOU'RE **PAYING** *FOR AN* **EIMCO AGIDISC**

WITHOUT GETTING ITS BENEFITS

PROPERLY DIRECTED AGITATION begins a chain of PROFITABLE results when you employ EIMCO AGIDISC. Uniform particle suspension promotes uniform, dry cakes . . . which in turn promote high capacity, low moisture, dependable operation and many other benefits.



Watching your production curve rise steadily is your assurance of greater returns from every $ you invest in Eimco equipment and in raw materials.

Check your equipment performance with an Eimco Sales Engineer. You can pay for a new Eimco Filter in a short time from increased profits and then realize the full economic benefits of MAXIMUM PRODUCTION at MINIMUM COSTS.

THE EIMCO CORPORATION

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B-869

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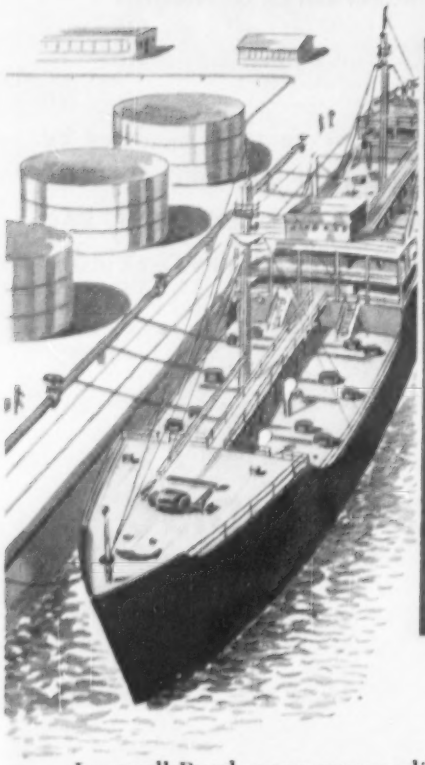
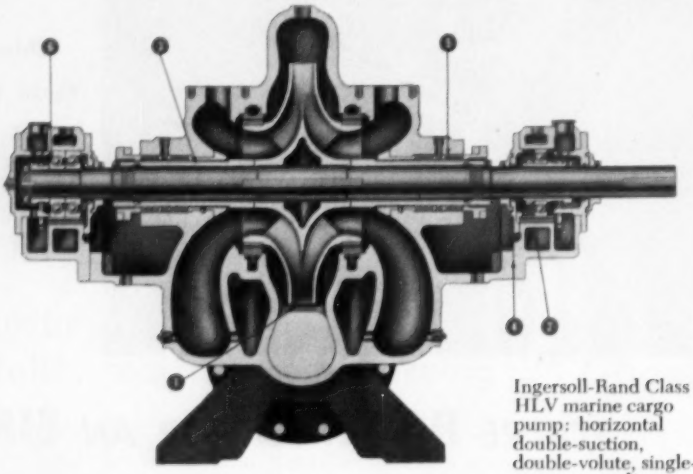
How I-R Cargo Pumps help tankers

CUT TURN-AROUND TIME





Ingersoll-Rand Class HLV marine cargo pump: horizontal double-suction, double-volute, single-stage type split on horizontal centerline

Ingersoll-Rand cargo pumps, like the Class HLV unit shown above in cross-section, are designed and built specifically for modern tanker service. They reflect the advanced design, and the dependable construction which is essential to profitable tanker operation. High capacity, plus high *availability* mean faster discharge of cargos and less dock time.

Class HLV cargo pumps are available in all capacities for marine service. They are ideal for handling oils, gasoline, kerosene and other liquid hydrocarbons, as well as non-petroleum liquid cargos. Your Ingersoll-Rand representative will be glad to give complete details and performance data on these or any other of I-R's complete line of marine pumps.

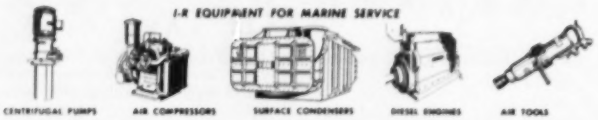
These construction features keep availability high and dock-time low

1. **DUAL VOLUTE CONSTRUCTION** minimizes radial loads on the shaft at all pumping rates.
2. **WATER-COOLED BEARINGS** maintain low bearing temperatures under all conditions and permit pumping at higher cargo temperatures.
3. **KEYED SHAFT SLEEVE** positively locks sleeve against reverse rotation. Packing between sleeve and shaft sleeve nut prevents leakage under sleeve.
4. **SEPARATE BEARING HOUSINGS** permit bearing replacement without removing rotating assembly.
5. **DEEP STUFFING BOXES** may be arranged for either packing or mechanical seals.
6. **DOUBLE-ROW, ANGULAR-CONTACT THRUST BEARING** and liberally sized radial bearing assure long bearing life. Labyrinth flingers at both bearing housings protect against entrance of dirt and moisture.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

I-R EQUIPMENT FOR MARINE SERVICE



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39,000# digging force plus "high leverage" contour of rocker arms . . give the Eimco 105 Excavator more digging force per pound of weight than any comparative machine.

Dumping into haulage units or fills, ability to discharge without turning gives the Eimco more productive motion per unit of expelled energy than any other earthmover.

Even With 100 ft. Round-Trip Cycle

THIS EIMCO EXCAVATOR MOVES 1050 TONS IN 7 HOURS

An Eimco 105 Excavator loads out large boulders and loose overburden without the aid of preliminary shooting . . . hauls 50 ft. to the edge of a fill . . . and discharges 500 — 3-ton-loads every 50 minute work hour.

Ability to complete a cycle without turning is a big Eimco Excavator advantage, regardless of haul length. But as travel distance decreases, the 105's loading speed increases in much greater proportion than that of conventional loaders.

When trucks can be spotted a few feet behind, and with good availability . . . the 105 can complete 6 cycles per minute and toss between 600 - 800 tons of heavy rock over its back every hour.

On projects with confined working space, the Eimco Excavator's cubic yard capacity per $ of investment increases sharply while the conventional loader's value deceases. Loading in tight quarters or on narrow benches, conventional machines must maneuver "back and forth" to reach dump position. This curtails production, increases operator fatigue jeopardizes safety and "bottlenecks" hauling operations. These profit-stealing disadvantages are eliminated by the 105.

With either the Excavator or the Eimco 105 Front-End Loader (2½ yd., 40,000# break-out) you get a big mobility edge. Under full load . . at top speed . . moving forward or reverse . . both 105 Loaders respond instantly to gear reversals, high-lo shifts, independent track operation - all controlled by easy - to - operate, power - shift levers.

An Eimco Sales Engineer will be happy to conduct a time study of your operation and show you the way to more profit!

EIMCO FRONT-END LOADER

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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B-270

Boom-mounted drills and wagon drills, equipped with 1¼-in. round Bethlehem Hollow Drill Steel, bite into rock at site of Bear Creek Dam, on Lehigh River in northeastern Pennsylvania. Supervising Authority: U. S. Army Corps of Engineers. Prime Contractor: Gasparini Excavating Co., Inc., Peckville, Pa. Drill Steel Reconditioner: Howells Mining Drill Company, Plymouth, Pa.

New Flood Control Project For Lehigh Valley

Shown here is part of the rock removal for the first phase of Bear Creek Dam and Reservoir, a huge flood control project under construction on the Lehigh River at its confluence with Bear Creek, near White Haven, Pa. The blast holes for the 125,000 cu yd of rock and earth excavation were made with Bethlehem Hollow Drill Steel.

The earthfill dam and reservoir, plans for which were accelerated by hurricane and flood damage in 1955, is being constructed under the supervision of the U. S. Army Corps of Engineers, Philadelphia District. It is designed to provide flood protection for Allentown and Bethlehem, as well as other communities along a 75-mile stretch of the river. Upon completion, the dam will be 234 ft high, and 3000 ft long. The reservoir will accommodate the water runoff from 288 sq mi of drainage area, and will have a capacity of 108,000 acre-feet.

Bethlehem Hollow Drill Steel is ideal for any type of rock removal because it is rolled from fatigue-resistant steel. Its hole is uniform, and centrally located. It has a wide quenching range. It is easy to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades in rounds, hexagons and quarter-octagons, in lengths of from 18 ft to 27 ft. Longer lengths can also be furnished.

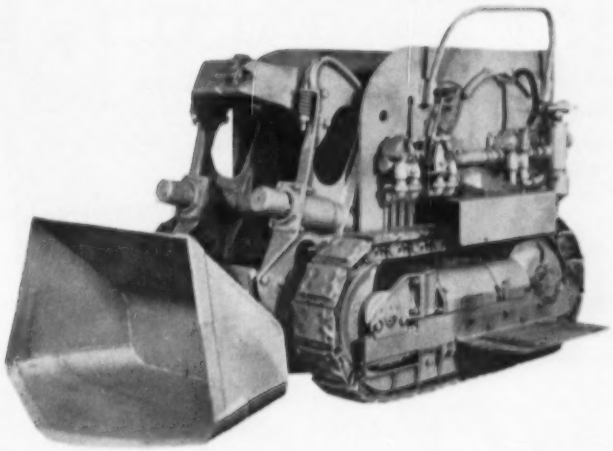
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

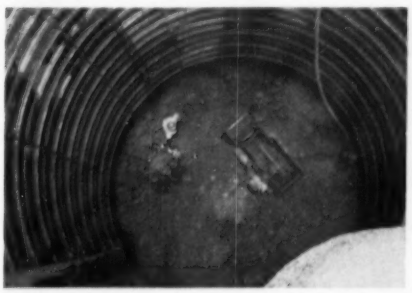
BETHLEHEM STEEL

EIMCO 630's . . CUSTOM DESIGNED TO FIT YOUR JOB CONDITIONS



With half flat and half grouser track shoes, this Eimco 630 is equipped to crowd and maneuver efficiently in a narrow shaft. Two bulldog teeth guide the bucket directly into a muck pile . . an important factor in shaft mucking. Many special accessories permit Eimco to custom design 630's to fit your specific loading scheme.

The Eimco 630 now can be equipped with special "incline" rocker arms to give it the same excavating and loading efficiency on steep grades that is achieved by standard arms operating on the level. With complete data at their disposal, Eimco's Engineering Staff can recommend the rocker arm assembly most pofitable for you.



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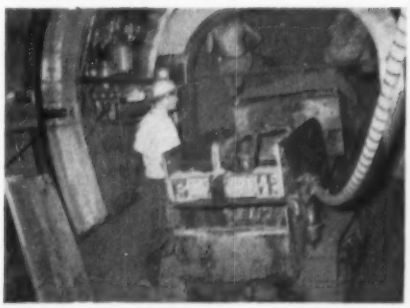

SAND TUNNELING:

Mining from draw points, open stopes or drifts -- in development or production work . . driving rock or running ground tunnels . . and various surface loading applications, EIMCO 630 TRACTOR-LOADERS muck for progressive firms seeking faster, more profitable excavating methods.

Eimco's willingness to evaluate new ideas suggested by members of the Mining Industry or developed from on-job surveys by Eimco Sales Engineers . . . has resulted in many precision "alternate" designs and accessories. These features -- when engineered into the basic Eimco 630 -- provide you with a "specialized" machine to handle the requirements of your particular job . . faster and more profitably.

SURFACE LOADING:

OPEN STOPES

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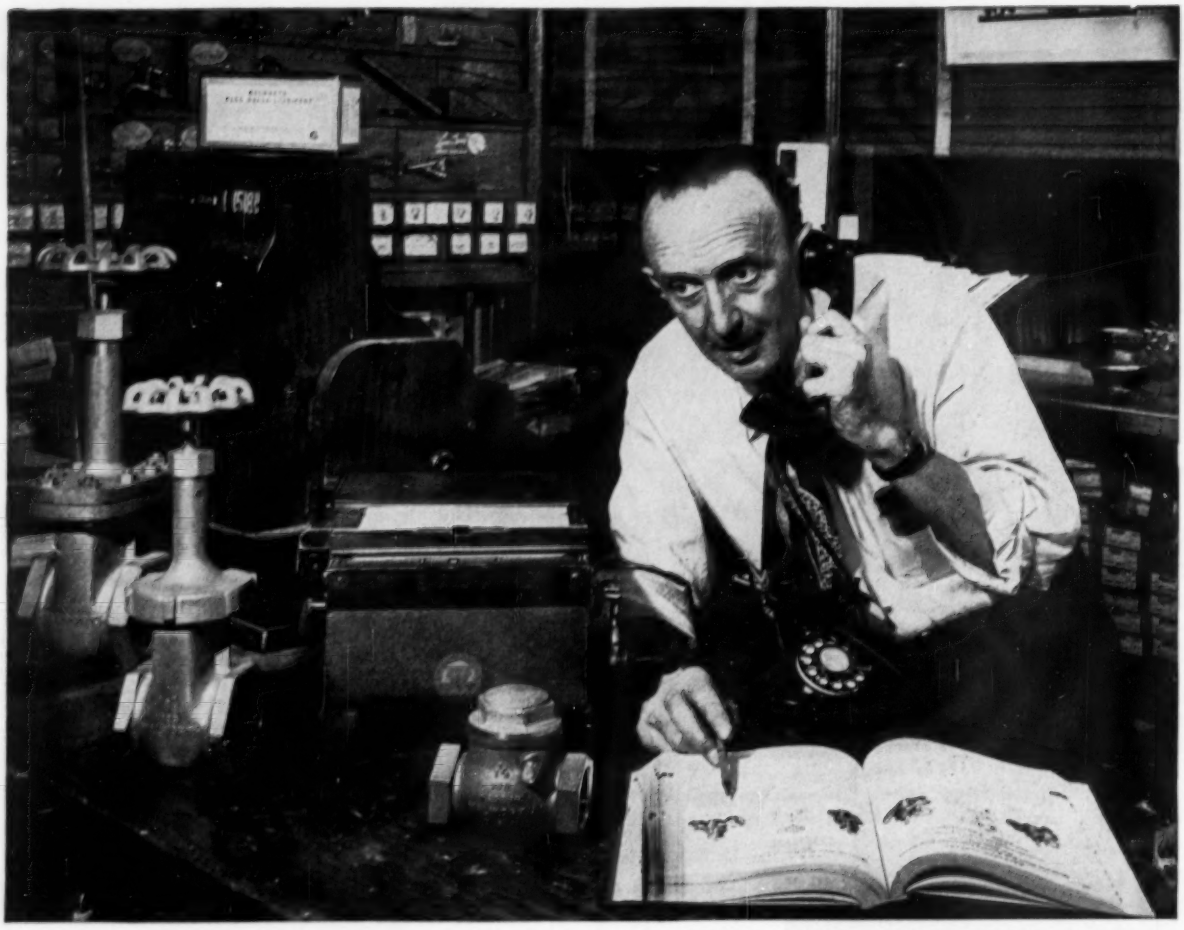
B-268



*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical – emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth – a complete line manufacturer.

There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

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Walworth Company of Canada, Ltd., Toronto

ON THE COVER

OUR cover picture shows a wooden trestle on the Northern Pacific Railway in 1900. Located between Cul-de-Sac and Grangerville, Idaho, it has since been replaced with a steel structure. For the most part, diesel-electric engines have also replaced steamers on almost all American railways. In the background of the picture is a less pleasantly remembered aspect of 1900 Americana—the denuded hillside that represents a thoughtless method of forestry we have now forsaken for a conservation-minded type. While we can remember wooden trestles and steam engines with nostalgia, no one seems to mind the passing of nineteenth century land stripping.

•

IN THIS ISSUE

WATER is an expensive commodity today. In those parts of the world where it isn't plentiful, schemes costing millions of dollars must be worked out to supply it. It's also expensive to obtain even for cities located close to large bodies of fresh water. The City of Oswego, N. Y., situated on the banks of Lake Ontario, is spending several million dollars to bring the lake water into its mains. One of the chief features of this program is a $1,753,415 subaqueous tunnel and intake crib, the construction of which is described in our first article.

•

BACK in the 1890's Cripple Creek, Colo., was a roaring gold camp in the best tradition of the old West, but it was in an isolated spot—a million miles from nowhere was how some of its inhabitants described it—and there was no way short of muleback to get supplies into the town. A group of Canon City business men (Canon City was only 25 or 30 miles away, belying that million-mile estimate) carved and hacked a road from their bustling town into Cripple Creek so that they could reap some of the profits to be had in the gold-rich camp. The toll road they built is still in evidence, although long out of use. Some of the history of the Shelf Road to Cripple Creek is told in the story beginning on page 200.

•

WHEN Tidewater Oil Company built its huge, multimillion dollar refinery at Delaware City, Del., they needed a firm source of power for the installation. Delaware Power & Light Company responded by building a 50,000-kw steam central station adjacent to the refinery to supply it with power, process steam and treated water. The Delaware City Station burns a new kind of fuel, and this and other features of the facility are described. Page 204.

Compressed Air Magazine

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VOLUME 62 **July 1957** NUMBER 7

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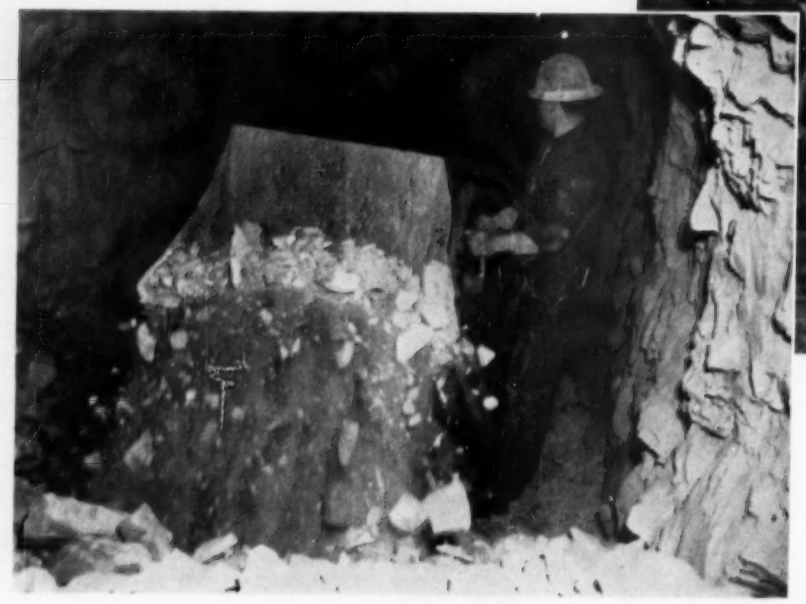
OSWEGO WATER TUNNEL

1.18-Mile Bore to Carry Lake Ontario Water to City Mains

R. J. NEMMERS

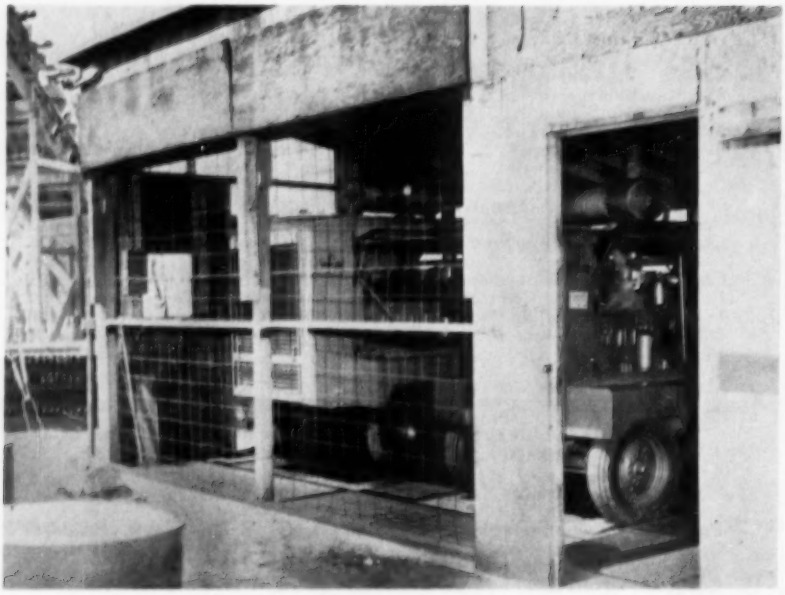
THE CITY of Oswego, N. Y., is constructing a water supply system that, when completed, will be the envy of many cities having double or more its 23,000 population. The main feature of the project is a 6250-foot-long intake tunnel, 8 feet in diameter, extending under Lake Ontario. It will bring fresh, offshore water to the city mains. The lake water is classified by engineers as "excellent," especially when it is taken from a point far offshore. It will require comparatively little treatment to render it usable. As a part of the overall rehabilitation of the city's supply system, a new pumping station is being built on the lake shore, just 75 feet from the tunnel shaft.

County seat of Oswego County, the municipality is about 35 miles northwest of Syracuse on the mouth of the Oswego River. There, the Oswego Canal, part of New York State's famed barge canal system, enters Lake Ontario. The canal connects the Great Lakes with the Erie



DRILLING AND MUCKING

The drilling setup at Oswego Tunnel is shown above (right). Three Ingersoll-Rand JR 38-B Jackdrills were used for the entire length of the tunnel. Thirty holes, including two 15-foot pilot holes to test for water, were drilled for each round. An Eimco 21B Loader (above) mucked the approximately 30 yards of rock brought down with each shot.



AIR SUPPLY

Two I-R Gyro-Flo rotary compressors supplied air to the drills, an auxiliary air-operated sump pump and an Impactool used in roof pinning work. One, left, delivered 600 cfm and the other was rated 315-cfm delivery. During the job the machines were housed in the frame structure shown.

Canal at Syracuse. The Oswego link was begun in 1825 and completed 3 years later, at which time the Village of Oswego was incorporated. Costing about $12 million including some later improvements, the canal has seven locks and is 12 feet deep. It handles barges about 40 feet in width and drawing up to 10½ feet of water. Four to 4½ million tons of cargo still move along New York's inland waterways each year and a good percentage of it moves through the Oswego Canal. Approximately 2,000,000 tons of cargo, including some moving along the St. Lawrence Seaway, are handled each year by the Port of Oswego Harbor.

The City of Oswego has played an important part in the history of the area and of the country. The site was first visited by Champlain in 1616. Governor

HEADFRAME

Access to the single-heading tunnel is through a 12-foot diameter circular shaft 130-feet deep. Muck brought up through the shaft in a Darling-designed skip was chuted to a waste pile and then spread out along the lake shore to serve as a seawall and spending beach. An enviable safety record was set during the job—no lost-time accidents occured in driving the 1.18-mile-long bore. In the foreground, lengths of Naylor 12-inch Spiralweld pipe are being readied to go underground. The pipe carried fresh air to the heading.

Bennett founded an English trading post there in 1722, fortifying it 5 years later. In 1755-56, forts Ontario and Oswego were built on opposite sides of the Oswego River. Many battles of the French and Indian War were fought there and it was an important post during the Revolutionary conflict. Fort Ontario was rebuilt by the United States and garrisoned as late as 1905.

The Oswego intake tunnel parallels and will replace a 30-inch diameter cast iron pipe extending 8000 feet into the lake and which is bedded on wooden cribbing. The pipe is not only in need of extensive repair, but it can neither handle the volume of water required by the community nor supply new industries which the city hopes to attract when the St. Lawrence Seaway is completed next year. Extensive survey work done both by city engineers and the consultants, Nussbaumer, Clark & Velzy (Buffalo, N. Y.), indicated that a tunnel, rather

PUMP STATION

Four I-R pumps were in operation in the tunnel to handle any water that might have been encountered. In the foreground of the picture above is shown an RVH Motorpump. The other two units (background) are belt-driven machines, and behind them is shown the tunnel power substation. An auxiliary air-operated sump pump, not shown, was in the sump. At the right can be seen a loaded muck car. Cars were dumped by an overhead air cylinder.

than repairs and additions to the present structure or a new trenched pipe, would be the most economical long-term investment assuring a constant supply of good water.

The tunnel was driven by Herbert F. Darling General Contractor, Williamsville, N. Y., from a single heading turned from a 130-foot access shaft and water riser sunk only a few yards from the lakeshore. The shaft (135 feet deep, counting a 5-foot sump at the bottom) was started by driving sheet piling. The upper 33½ feet is square, measuring 33 feet across and the remainder is circular with a 12-foot diameter. A jumbo shaft-sinking rig made up of two drills mounted on a quarry bar which was, in turn, arranged to rotate on a circular track, was brought into use when rock was encountered. The shaft was bottomed July 26, 1956, and the tunnel heading turned shortly thereafter.

The tunnel itself runs on a heading of north, 39 degrees west, rising on a 0.25-percent grade to end more than a mile away and 40 feet beneath the lake bottom. Drilling was done with Ingersoll-Rand JR38-B Jackdrills using I-R 1⅝-inch Carset (tungsten carbide insert) bits and Crucible EEEE alloy drill steel. Three drillers and two helpers were at work in the face and the same crew mucked with the aid of an operating engineer on the loader. At the start of each round, a third helper worked in the heading, but after drilling was well under way, was pulled back and assigned to roof bolting or other work.

The Carset bits at the start of the job drilled about 300 feet before being discarded after several sharpenings. Then an I-R J3 Jackbit Grinder was installed in the blacksmith shop to handle bit reconditioning and by maintaining the correct sharpening angle boosted bit footage to 475 to 500 feet. Thirty holes were drilled for each 8-foot round including a burn cut and two 15-foot-long pilot holes carried in advance of the bore to test for water. Holes were loaded with Du Pont Gelex No. 1 powder. Millisecond delay caps were used and the blast was fired from about 1000 feet back in the tunnel. Blasting produced a uniform muck pile close to the face. Generally speaking, two rounds were drilled, mucked and blasted per shift, about 30 yards of rock being brought down with each shot.

An Eimco 21B Loader was used, mucking into 1 yard end-dump cars which were then hauled to the shaft in 10-car trains by a Mancha storage-battery-operated locomotive. Switching was accomplished on a California switch maintained a few yards behind the heading. The muck was raised to the surface in a 1-yard skip, designed by the contractor, and dumped through a chute to a waste pile beside the headframe. An International Harvester TD-9 tractor bulldozed the rock into a seawall and spending beach along the lake side to prevent encroachment of the lake on the new pumping station. The seawall also will help to protect the station against ice damage in the spring—prevailing southerly winds during spring breakups frequently pile ice high on the shore at that point.

Air for the drills was supplied by two Ingersoll-Rand Gyro-Flo rotary portable compressors, one of 600-cfm capacity and the other delivering 315 cfm. The compressors were linked together, discharging air to a common manifold from whence it was conveyed underground in a 1000-foot 6-inch, 2000-foot 4-inch, 3000-foot 3-inch main. Ventilation air for the tunnel was supplied by two blowers hooked in tandem and having the intake and discharge interconnected through a valve arrangement so that air could either be blown into or exhausted from the tunnel. After each blast, the resulting fumes were exhausted for about a 20-minute period, after which crews were able to resume work. The rest of the time the blowers pumped fresh air into the workings.

As we have said, the tunnel ends approximately 40 feet under the lake bottom. A riser was driven, also by Darling crews, to within a few feet of the lakebed. Over the riser, Merritt, Chapman & Scott Corporation will place a 54-foot-diameter octagonal strainer and inlet structure. The remaining rock plug in

the river will be blasted free, the muck dropping onto a platform erected in the shaft below the plug, then removed by a clamshell and diver from Marine Equipment. After this, the wooden-grill steel-truss intake structure will be placed in position. The water is approximately 40 feet deep over the riser.

When the project was started, specifications had been laid down for a concrete-lined bore, 7 feet in diameter. Accordingly the tunnel was driven to a nominal 8-foot diameter, but the rock encountered is so uniformly solid that very little concreting will have to be done. The rock strata, a hard gray limestone, extends from 32 to 75 feet about the tunnel roof. The rock is self supporting, however Bethlehem Steel Company roof bolts were used throughout as a safety measure. Of 3- to 6-foot length, they were set into holes drilled with the Jackdrills and tightened with an I-R Size 514 Impactool. Both stringers and square plates were used.

The tunnel is almost bone dry—only a few faults were encountered that required grouting. For the most part, however, the three pumps installed to lift water from the sump to the surface had only to handle about as much water as the contractor was pumping into the tunnel for the wet drilling. What little seepage there is into the unlined portions of the tunnel will be excluded by the hydrostatic pressure of the lake water when the tunnel is filled. The shaft, however, was a different story. Lined throughout, it passed through several open seams that admitted large quantities of water. Strangely enough, the water was salty, indicating that it did not come from the nearby lake. No great difficulties were encountered in sealing off the flow. Just below ground level a second tunnel, extending 75 feet due south of the shaft, was driven. It will carry water from the shaft to the pumping station. Also 8 feet in diameter, this tunnel will be lined with 72-inch lock-joint concrete pipe, each 10-foot section of which weighs 7½ tons. These sections will be set into concrete cradles; and when this has been done, the surrounding voids will be backfilled with a lean mixture of concrete.

SHIFT CHANGE

The crew of men shown in this picture came off duty at 3:30 p.m. In the background can be seen Lake Ontario. In general, each shift drilled, blasted and mucked two rounds. In the left foreground a section of the sheet piling driven to bed rock around the access shaft is visible.

BIT RECONDITIONING

At the start of drilling on the project, bits were sharpened by hand and drilled about 300 feet before being discarded. Then the J3 Jackbit grinder, shown above, was put on the job, and by assuring that the bits were sharpened to the correct angles, boosted footage to 475 to 500 feet.

Progress on the tunnel has been good. Beginning the tunnel with two shifts, working six days a week, about 1000 feet was completed. Then, as soon as qualified tunnelers could be obtained, a third shift was added. The tunnel was completed May 21, and the riser to the lake bottom was finished a few weeks later with the exception of removing the final plug. During the month of March the best over-all showing was made with an advance of 950 feet. The best week's advance was 228 feet from March 11 to 17. The over-all project, including pumping station and other appurtenant structures, is scheduled for completion in December.

The project is under the supervision of Raymond H. N. Murray with George Stuart Patrick ("Pat") McNulty, resident engineer for Nussbaumer, Clarke & Velzy; L. P. ("Woody") Heiston is general superintendent for Herbert F. Darling General Contractor; and Phillip Aylor and George Pollick are tunnel bosses. Kenneth D. Jensen, Superintendent of Water, is supervising the work for the City of Oswego.

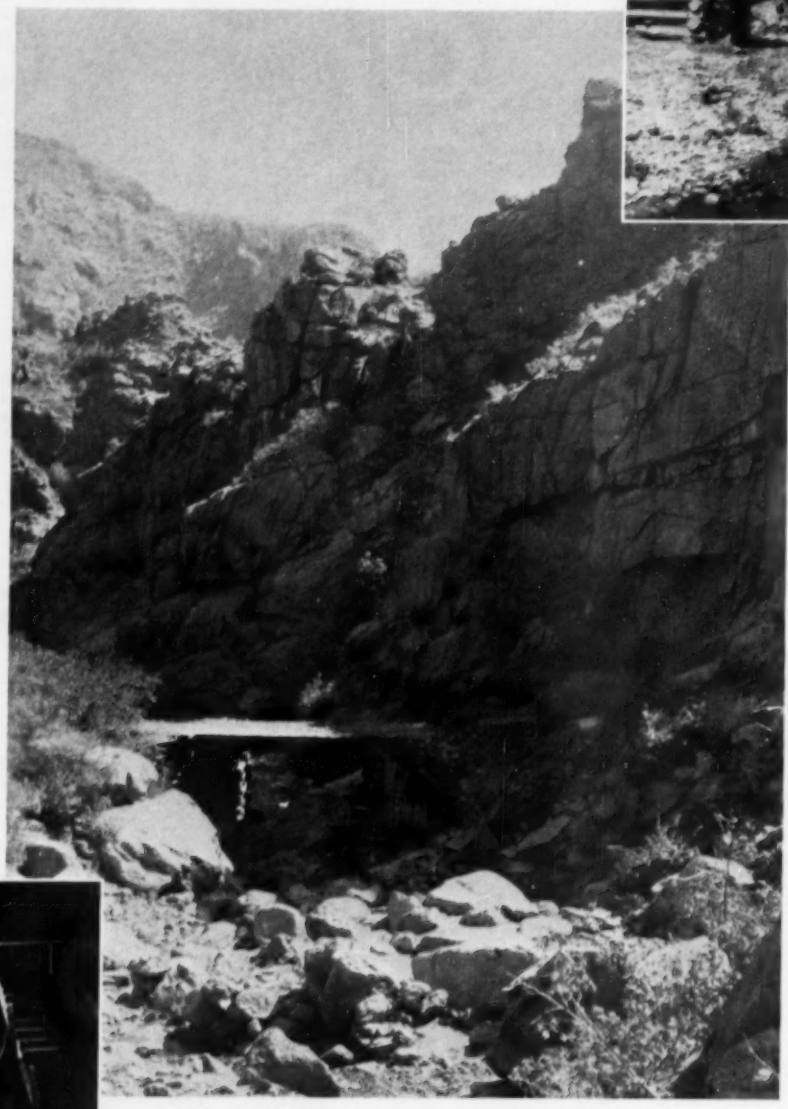
THE SHELF ROAD TO CRIPPLE CREEK

CAREY HOLBROOK

CRIPPLE Creek, Colo., in the early 1890's was a booming gold-mining camp. A year or so before that, Bob Womack, after a 12-year search, had uncovered a rich vein, and the lure of yellow metal was turning the former cattle range into a seething Mecca for gold-hungry men. They poured into the region in wagons, buggies and carts; and on pack animals, blooded thoroughbreds and on foot. There were no railroads and few roads through the mountains.

Twenty-five or 30 miles away, at the foot of the intervening mass of mountain and canyon, was the small but bustling town of Canon City where supplies were available to take care of the demand in Cripple Creek. But there was no road to get them there, and Canon City business men were tearing their hair.

The old red courthouse stood in the middle of Canon City just as it does today. Stamped into the cornerstone are the words "Rebuilt in 1886." Within the building's neat and orderly vaults are well-kept record books dating back to 1862. Among them is a hand-written document showing what the astute business men of Canon City did about building a road that would allow them to cash in on the gold rush. The date of filing is

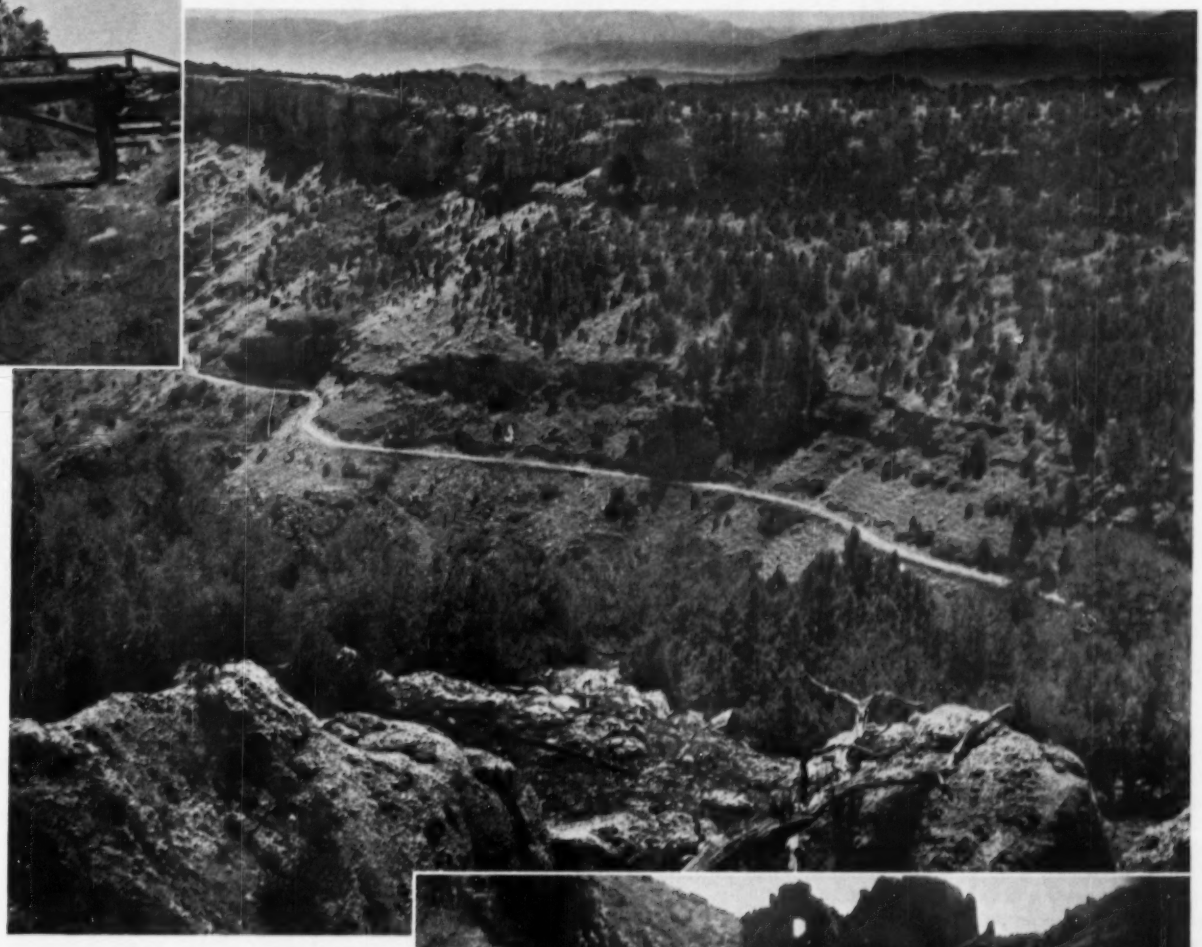


OF BRIDGES AND TUNNELS

At the bridge shown at the top, the original Shelf Road left Four Mile Creek and wound its way up to the head of Wilson Creek to the little town of Marigold. This route was later washed out and a rough detour replaced it. The detour passes the portal of Carlton Tunnel (left). The bore, finished in 1941, drained the Cripple Creek mines and dried up spring-fed Wilson Creek. In the center picture is shown one of nine bridges that were built over Wilson Creek in one stretch of only a few miles. The narrow bridges allowed only one vehicle at a time. Although this one is still passable, many are not and rough, almost impassable detours down into the creek bed have taken their place.

THE SHELF ROAD

A virtual aerial view of the Shelf Road is shown below. The picture was taken about 1000 feet above Four Mile Creek and from just under the rim rock. The road now is impassable to all but horses and jeeps—even in its heyday it was little better, but it opened up a fabulous gold mining area. In the picture beneath it, a window rock overlooks a boulder-strewn section of the road. The window is quite large and is visible for several miles along the trail.



November 25, 1891. It is written on a page of foolscap paper, and the ink is still clear. Heading the page is the title, "ARTICLES OF INCORPORATION OF THE CANON CITY AND CRIPPLE CREEK TOLL ROAD COMPANY." The names signed there are, Wm. B. White, Dr. Joseph L. Prentess, Dr. Jas. M. Bradbury, Robert Savage, Thos. L. Wills, C. G. Nikerk. These were the officers and directors of the company. Robert Savage was a hardware merchant; and Tom Wills, a former county commissioner, a politician of a sort and a trader in real estate. Nikerk was a station agent for the Denver & Rio Grande Railroad at Canon City. But the driving force behind the corporation was Wm. B. White—"Cap" White as he was known far and wide.

Cap was a doughty Scotsman who once commanded a sailing vessel. In 1848, he left his home in Virginia for the gold field of Australia, walked across that continent and didn't like what he saw. The next year he landed in the California gold rush, and about 1852 or '53 was back again in Virginia to visit his wife and a 4-year-old son whom he had never seen. About 1859, he went to Leadville, Colo., where he was mixed up in every-kind of mining activity. Some time in 1885 or 1886, he turned up in Canon City as head of an irrigation system, and it wasn't long until he was engaged in half a dozen other enterprises. The Shelf Road to Cripple Creek was one of them. After his engineers had surveyed the ground and reported that the country was too rough to build a road, the Captain rode across the mountains on horseback and laid out the route himself. Then he proceeded to build it.

The corporation had an authorized capital of $15,000, of which $6363.12 was paid in at the time of organization.

TOLL GATE SITE

The lower toll gate of the Shelf Road was located at this point. In the background are the crumbling ruins of an old lime kiln that burned lime used in rebuilding Cripple Creek after the fire that destroyed the community. Of the small stores and bunkhouses that once lined the road at the toll gate, no trace remains.

By 1894, when the first annual statement was filed, the capital had gone up exactly $100! That is all the money put into building of the road. Any cost above that amount must have come from profit on the operation, but nobody knows what that was.

At any rate, with an investment of $6463.12 these road builders put in a toll road that, in many places, was blasted out of the side of a mountain. Along the edge of breath-taking canyons it went, across Four Mile and Wilson creeks in a dozen places with bridges built of huge logs. The road is still there today, rough and rugged and steep, but still there!

Much of the Shelf Road was—and is—too narrow for vehicles to pass. In many places a cliff stretches up to the sky on one side, and a canyon drops off on the other. As you crawl along the dizzy way your eyes drop to the edge of the road and way down there is the ruin of a house, some tiny trees and a bright trickle of water that is Four Mile Creek.

Along this route in the early 1890's, a stream of traffic made its way into Cripple Creek, Victor and the other gold camps. And out of the district went a long line of heavy wagons, heaped high with gold-bearing ore consigned to the reducing plant at Florence. Three United States post offices were born along the road: Lawrence, first out of Cripple Creek; Marigold, in the middle at the head of Wilson Creek; and Eldred, 12 miles from Canon City in a settlement known as Garden Park. In order to carry the mail and passengers, a stage line was established and operated one stage a day each way. Running time was 4 hours downhill, 6 hours up.

Thirty-six horses were used on the run, four at a time with each stage. Quick changes were made at Eldred, Marigold and Lawrence. At each of these places, small stores, eating places and bunk houses were built, and there were barns and corrals to take care of the horses. Seven passengers was a full load for the stage—six inside, and one on the seat with the driver. Four Calkin stages were owned by the line. The body hung on leather between the front and rear axles, which gave it a rocking motion instead of an up-and-down one, as is the case with vehicles built on springs. At the rear was the boot for baggage. Under the driver's seat was the bag of United States mail. Hanging from the hames of the leaders was a bell that jangled as they ran, so that teams coming toward them on the shelf would be warned and look for a wide place where they could pass. Many times that wide place was a long way off. When the stage came up behind a 6-horse rig going the same way, it might crawl along behind for an hour or so waiting for a passing area.

The first operator of the stage line was a man named Kuykendall. About 1894, the line was purchased by Elwood—known as "Woody"—Higgins, and Charley Canterbury, who operated it until the competition of railroads and the building of a free road through Phantom Canyon put them out of business. Woody Higgins is still alive and active, 88 years old. He is cattle buyer for the Colorado State Prison, which slaughters about 60 head a month. Charley Canterbury is dead, but his son, also Charley, is sheriff of Fremont County with headquarters at Canon City.

Woody Higgins came to Colorado in 1884 and went to work for the Reynolds Ranch, which was a cattle spread located on land that later became Cripple Creek. During the time he was a partner in the line, he drove the stage over the Shelf Road. Of the many wheel horses on this run, he has no memory. But clear in his mind after more than 60 years is the picture of Maude and Nellie, a high-stepping span of Kentucky-bred mares, blaze-faced sorrels weighing about 1000 pounds each. As far as Woody Higgins is concerned they were the best leaders that ever tightened a tug.

Two toll gates were located on the Shelf Road; one at the upper end a mile or so from where it broke out into the open with Cripple Creek not far away; and the other at the lower end, shortly before it crawled off the shelf into the

comparatively flat country about 12 miles from Canon City. Charley Canterbury collected at one of them; and W. O. Higgins, younger brother of Woody Higgins, at the other.

The Shelf Road operated as a toll road for only 5 or 6 years. The last annual statement of the corporation was filed in February 1896, but there is no record that it was then dissolved. During those years builders of railroads were pushing narrow-gauge tracks into the hills, and three lines eventually reached Cripple Creek, where the peak population is said to have been 50,000. Eleven gold camps came into being in the district: Cripple Creek, Victor, Goldfield, Lawrence, Mound City, Altman, Elkton, Arequa, Gillett, Anaconda and Independence. At one time all were connected by an electric railway. The records show that $432 million worth of gold was taken from this area between 1891 and 1952. Current annual production, some of it from old mine dumps, is worth close to $2 million.

The first railroad to reach the town was the Florence and Cripple Creek, built by David Moffat and his associates, and incorporated April 17, 1893. The next year the Midland Terminal pushed its way from Colorado Springs up Ute Pass, then sent a branch into the Cripple Creek area. On December 10, 1894, it reached Victor, and on December 18, was ready to accept freight out of Cripple Creek. The third line was the Colorado Springs and Cripple Creek District Railway.

With competition like this the Shelf Road, as a toll road, folded. Charley Canterbury filed on a homestead in the deep canyon below the road, and started ranching. Woody Higgins went into the cattle business and extended his operations as far south as Old Mexico, shipping trainloads of steers into the States.

Years later a flood that started at the head of Wilson Creek washed out a portion of the road. This part has never been rebuilt, but a rough detour was blasted out around the washout. It goes by the portal of the Carlton Tunnel, a 10x11-foot, $1,250,000 bore that was driven 6.2 miles through rock in 1939-41 to drain the Cripple Creek mines and eliminate heavy pumping costs. The water drawn from the mines now pours out of the tunnel over the Shelf Road and on down into Four Mile Creek. The minerals it bears leave green stains on the rocks in the upper end of the creek. Far below where it tumbles out into a farming section, the water is used for irrigation, having been purified on its long journey down the canyon.

When the toll road was in operation, Wilson Creek started at a big spring where the temperature of the water remained the same, winter and summer. The upper stretch of Wilson Creek did not freeze over in the coldest weather, and mountain trout inhabited its pools. Since the Carlton Tunnel was driven, the spring has ceased to run and Wilson Creek is now dry.

To the stout hearted the Shelf Road is still open between Cripple Creek and Canon City. But it is no thoroughfare for the timid driver, nor for any kind of a car except the rugged jeep. For about 12 miles it is little more than a trail, wide enough for one vehicle at a time. The difference in elevation between the two extremities is around 4500 feet, and in some places grades are very steep. Gone are the post offices of Eldred, Marigold and Lawrence. Gone are the toll gates. Nothing of them is left except scars on the rocky ground where they once stood, and memories in the hearts of a few old men. If you have the urge to take this way across the mountains, you have no worry about finding wide places where you can pass oncoming vehicles, for only by the merest chance will other travelers be there.

But if you have an eye to look back across the years that have gone, and an ear to listen to voices long since silenced, there are compensations along the shelf. Sweeping around those curves hung high on a rocky bath gouged out of the mountain side, you will see the Cripple Creek stage on its way to the town where gold may be had for the taking. Sitting on the box seat with the United States mail under him will be young Woody Higgins, calm, confident and sure in his mastery of the four horses under his hand. You will hear the clang of iron wheels on a rocky road, the squeal of brakes and the soft squeak of a stagecoach body rocking on leather. And the plunging leaders pulling that stage, bells jangling at their hames, will be Maude and Nellie, a pair of blaze-faced Kentucky mares, the best lead team in all the tumbled land of Colorado!

TOLL SCHEDULE

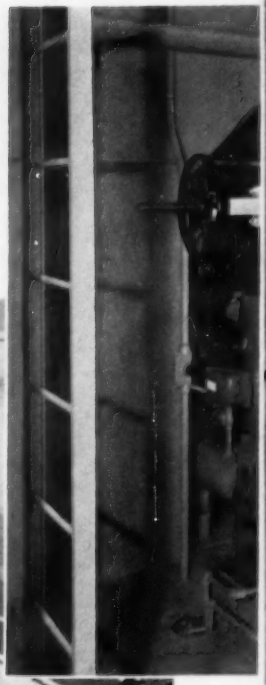
This sign, now hanging in the Canon City Museum, supposedly hung at one or the other of the toll gates. According to Woody Higgins, a partner in the stage line that ran on the Shelf Road, it isn't quite right. At the upper gate, tolls were collected from travelers going down and at the lower gate, from those going up. There was no collection from the same traveler at both gates, as is indicated on the sign.

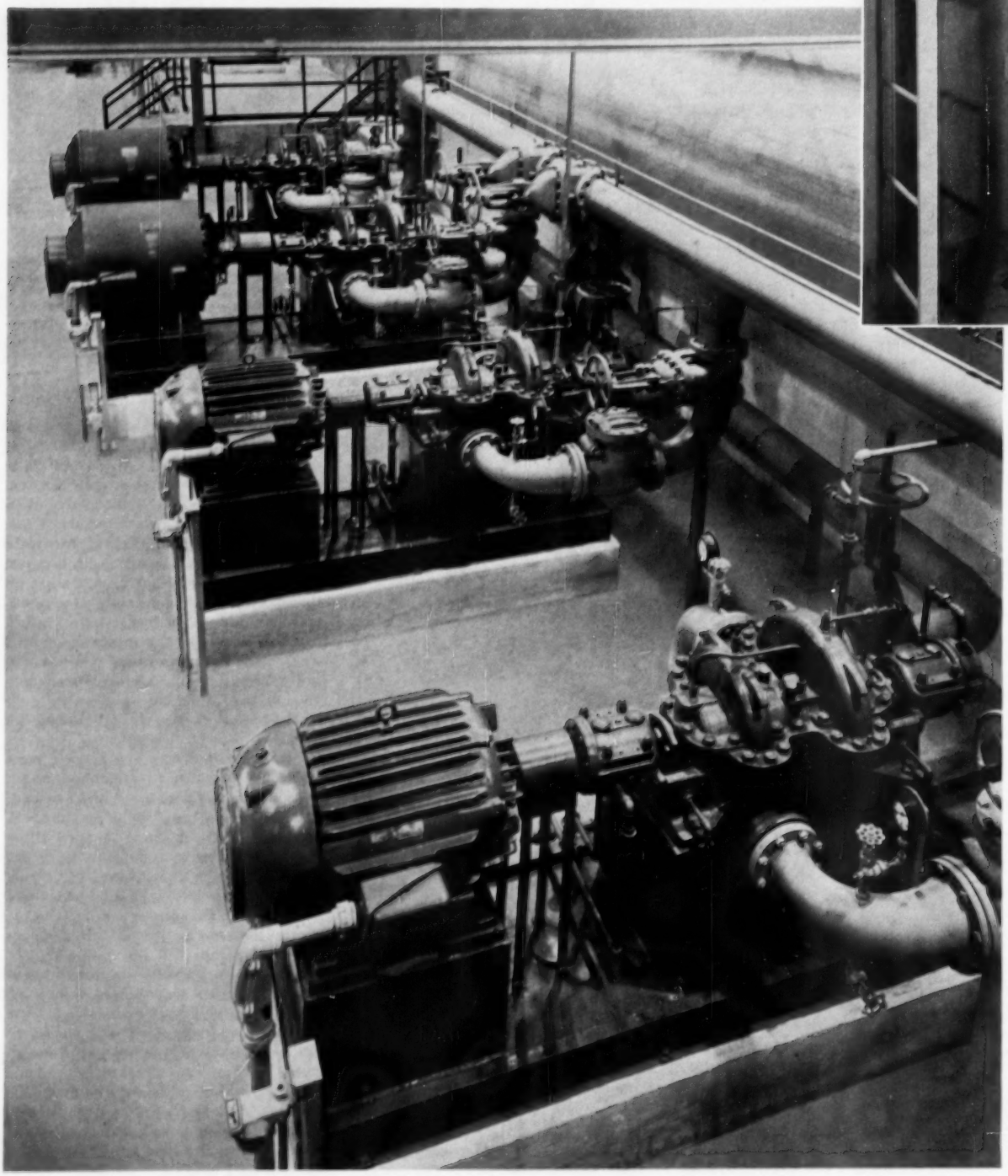
CRIPPLE CREEK STAGE LANDING

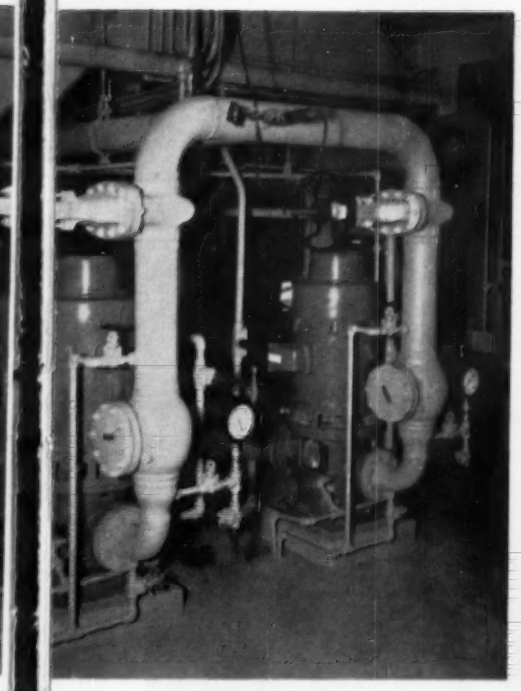
The 4- and 6-horse stages that wended the tortuous trail to and from Canon City landed in front of the old Palace Hotel in Cripple Creek. The stages could carry seven passengers, six inside and one beside the driver. Mail was carried to three wayside post offices as well as between the two mining camps. Horses were changed at each post office. This picture, taken about 1895 when the line belonged to Woody Higgins and Charley Canterbury, shows two 6-horse rigs.

CONDENSATE PUMPS

One unusual feature at Delaware City Station is the condensate return system. Shown at the right are two of the four station condensate pumps taking suction from the turbogenerator condensers. They are Ingersoll-Rand 10 APHC 7 units, rated at 400 gpm each against a total head of 266 feet. They are driven by General Electric 40-hp induction motors. Approximately half of the 1,500,000-pound-per-hour capacity of the boilers is extracted for use in the refinery, some of it being used to drive turbocompressors. The condensate from these drives must be returned to the power station as a matter of economy: boiler make-up water is more expensive than the cost of pumping it. Below are shown the refinery condensate return pumps (background). The two I-R 5 GT units are rated at 900 gpm against a total head of 292 feet and are driven by 100-hp Allis Chalmers motors. The other two pumps in the foreground handle demineralized water, pumping it to the powerhouse where it is added to the boilers. Also of I-R manufacture, they are 6 GT units rated 1600 gpm each, working against a 292-foot head and driven by 200-hp motors.



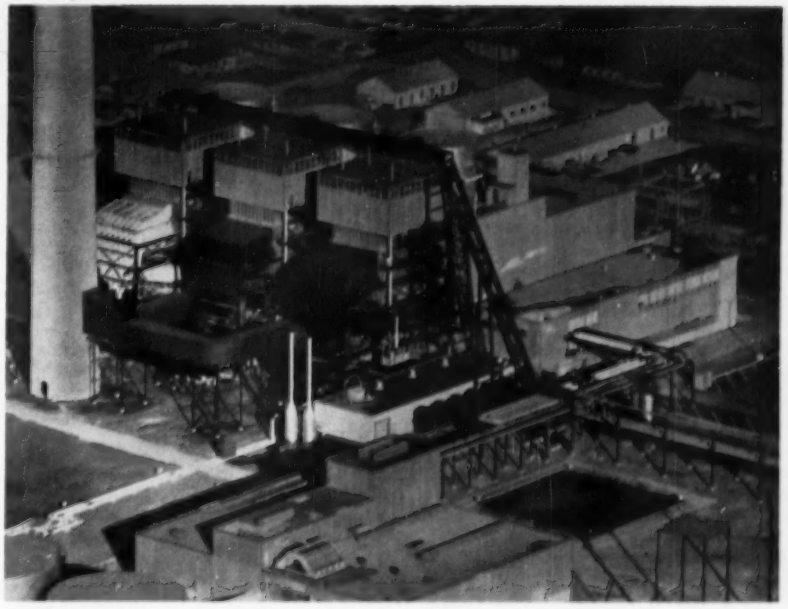




Delaware City Power Station

50,000-kw Steam Central Station To Burn Fluid Coke

Robert James



AERIAL VIEW

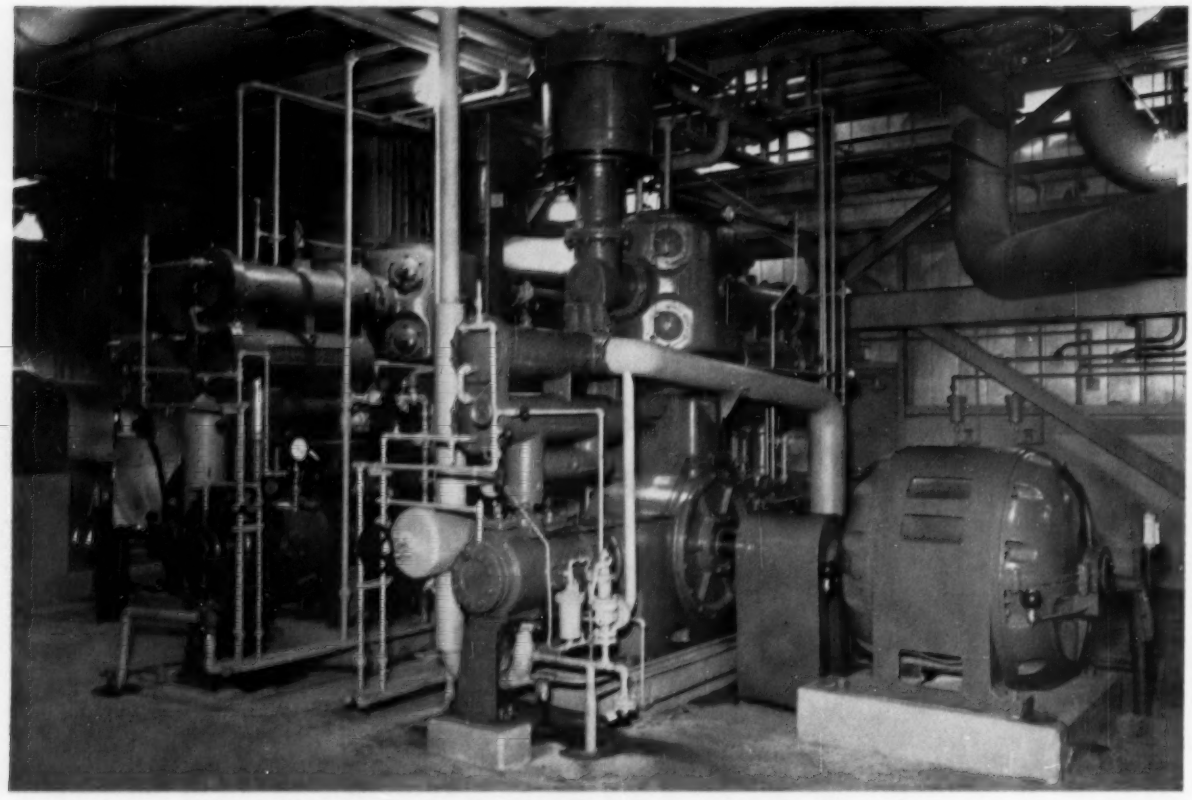
The DP&L Delaware Station viewed from the air. Visible on the roof are the three fluid coke storage silos and the lines feeding them. In the foreground a portion of the water treatment plant can be seen. The station virtually adjoins the fluid coker unit at the Tidewater Delaware Refinery from which the facility will get not only the primary fluid-coke fuel, but supplementary refinery gas and oil as well.

DESIGNED and built primarily to burn a new refinery product—fluid coke—The Delaware City Power Station of Delaware Power & Light Company went into operation last December to supply power, process steam and treated water to the Delaware Refinery of Tidewater Oil Company. The power station was designed and constructed by C. F. Braun & Co., Alhambra, Calif., in collaboration with DP&L engineers and consists of three 500,000-pound-per-hour Riley boilers, two General Electric extraction-condensing turbogenerators rated at 25,000 kw each at 3600 rpm, plus the necessary auxiliary equipment.

The electric power load for the refinery is about 40,000 kw, and the process steam demand about 800,000 pounds-per-hour. Until the refinery attains full production of the normal fuel supply of fluid coke, the station is burning refinery gas and oil. Some supplementary fuel will always be required because of the characteristics of fluid coke. It got its name because, even though solid, it behaves much like a fluid, especially when fluidized by compressed air. Consisting of spherical particles of about 35 mesh diameter, it is almost pure carbon, is extremely hard (particles rubbed on white paper will not smudge) and has an exceptionally high heat value—approximately 14,300 Btus per pound. The fuel contains about 5- to 7-percent volatile matter, burns to approximately 0.3-percent ash and has a high (about 1400°F) ignition temperature. The latter attribute is the reason that supplementary fuel is required—it was felt that combustion would be unstable without at least 10-percent supporting fuel and accordingly fluid coke, refinery gas and oil are to be fired simultaneously. In that way, if the supply of refinery gas is suddenly diminished, oil will be able to take over, without delay, the task of supporting combustion in the fluid coke.

The coke is delivered directly to the power station from the coker—they are virtually adjoining—by blowing it with compressed air through three 5-inch lines. Power plant operators institute coke deliveries, but when steel silos holding a reserve supply are filled, feed is automatically stopped and the coke diverted to other storage at the refinery. The design capacity of the transfer system is about 75 tons per hour. About 2600 cfm of compressed air at 90 psi is required.

The coke is stored on the roof of the station in three silos having 60-degree



SOOT BLOWERS

Two Ingersoll-Rand 17-9¾-5⅝x10-inch-stroke TVH compressors used for soot blowing at Delaware City Power Station. The 500-psi units have a capacity of 745 cfm each and are driven by General Electric 250-hp Tri Clad motors. Having three stages, they supply four blowers in the superheater sections of each boiler with either 250- or 350-psi compressed air. The soot blowers are electrically driven and are put into operation once a day, one boiler being cleaned each shift. The compressors are cooled by a closed system—softened well water circulates through the intercoolers and jacketing and then counterflows river water in heat exchangers.

conical bottoms and is fed to continuous scales, then down to coke feeders on the operating floor and then to pulverizers on the ground floor. The coke is mixed with a portion of the combustion air for feeding to the burners. The primary air supply is heated to about 600°F before entering the combustion zone.

Each boiler has twelve burners, each of which is equipped with three pulverized-fuel nozzles, two gas burners, and a wide-range oil nozzle. Many smaller burners and nozzles are used so that the hard-to-ignite pulverized coke will be exposed to the greatest amount of radiant heat possible. The burners are directed downward over a molten slag pool that is tapped about every 4 to 6 months in much the same way as a blast furnace. The slag bottom helps maintain high temperatures in the combustion zone and the opposing arrangement of burners increases turbulence thereby assuring complete combustion of all fuel put into the furnace.

Boilers are installed out-of-doors, are water cooled, 2-drum, 2-pass units and all exhaust to a common stack. The stack is 500 feet high—it is said to be the tallest structure between the Empire State Building in New York City and the Washington Monument in Washington, D. C.—and has an inside diameter of 32 feet at the base and 20 feet at the top. It has reserve capacity to handle a fourth boiler in the future and was designed to withstand winds of hurricane force. The boilers all discharge steam to a common 14-inch header at 1300 psig and 950°F. The General Electric turbine-generators are designed for a maximum throttle flow of 750,000 pounds per hour of steam at 1250 psig and 950°F total temperature. Process steam for the refinery is automatically extracted at 600 psig and 750°F.

The Delaware City Power Station is tied into the rest of the DP&L network through a 69-kv link, but there will be no interchange of current except in case of an emergency—the new station is designed to supply only the power requirements of Tidewater's huge refinery.

The relationship between the power station and Tidewater's refinery is unique. The refinery supplies fuel and cooling water to the power plant; electricity, steam and treated water are returned. The power plant is wholly owned and operated by Delaware Power & Light.

Three purification methods are in use at the water treatment facility operated in conjunction with the power station. The plant has an over-all capacity of 3200 gpm—enough to serve a city of about 200,000 persons. The source of supply is entirely separate from the 275,000-gpm cooling water supply which is taken from Cedar Creek at its confluence with the Delaware; it is instead drawn from 12 wells.

In the first, or pretreatment step, the water is aerated, filtered, chemically treated and distributed throughout the plant for human (domestic) consumption. The second method, used to provide make-up water for the boilers, is essentially a demineralizing step and turns out water having but two parts per million of solids. The third is a Zeolite chemical softening process and produces water for various refining steps as well as for the closed coolant system in use at the power station for cooling compressors and turbine bearings. River water counterflows the softened coolant in heat exchangers.

TORQUE CONTROL IMPACTOOLS AID TRUCK MANUFACTURER

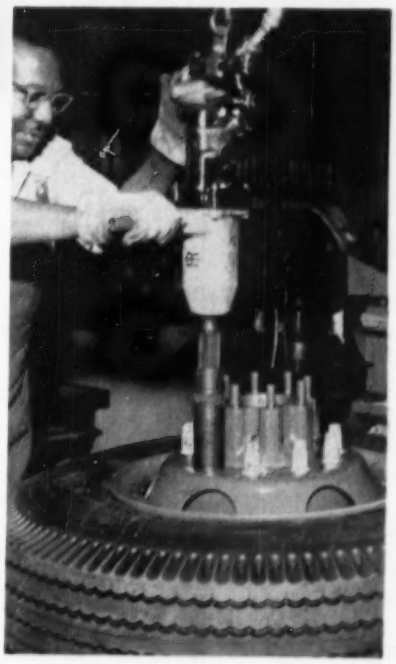
HARVESTER'S FORT WAYNE WORKS

The International Harvester motor truck plant at Fort Wayne, Ind. Pneumatic tools equipped with positive torque control are in use here to improve quality and save a great deal of arduous manual labor. Having a total of 1,683,000 square feet of floor space, the Fort Wayne Works is the sixth largest of the more than 20 plants owned or operated by Harvester and its subsidiaries in this country. Its chief product is a line of large motor trucks.

PNEUMATIC tools with automatic torque control features are helping International Harvester Company build safety and high quality into trucks assembled at its Fort Wayne, Ind., plant. A number of operations are now being performed with Torsion Bar Torque Control Impactools and the company reports a higher level of quality control is attained than was possible with conventional power wrenches. The Torque Control Impactools used are preset to generate any desired torque by twisting a calibrated torsion bar. The tool operates just as any other Impactool until it meets resistance equal to the preset torsion. Then the bar twists just a little more, adding rebound impetus to that of the impacting (hammer) mechanism. The slightly greater rebound trips an air valve and the tool stops.

One of the first applications on which Fort Wayne Works engineers used these tools was the assembly of Budd wheels to hubs. The wheels, 20 to 24 inches in diameter, carry tires of sizes from 9.00x 20 to 12.00x24. Ten mounting studs are used to hold the inner wheel of dual sets to the hub, and then ten retaining nuts are run to mount the outer rim. Because wheels are heavily loaded and subjected to constant vibration in service, the studs and nuts must be run to a uniform high torque so that there is no chance of their loosening on the highway, or breaking under shock loading because they are overstressed.

Prior to the installation of the automatic tools, the nuts were run with conventional power wrenches, the torque being guessed at by the operators' estimates of the length of time the tools impacted. To achieve the degree of quality control insisted upon by International Harvester, the torque had to be checked by both foremen and inspectors using hand torque wrenches. Because the required torque was 425 foot-pounds, the job was a slow and arduous one. With the Ingersoll-Rand Size 5340T Torsion Bar Torque Control Impactools now on the job the operator needs only to run his tool until it shuts itself off. Actually two tools are used: one with standard



MOUNTING WHEELS

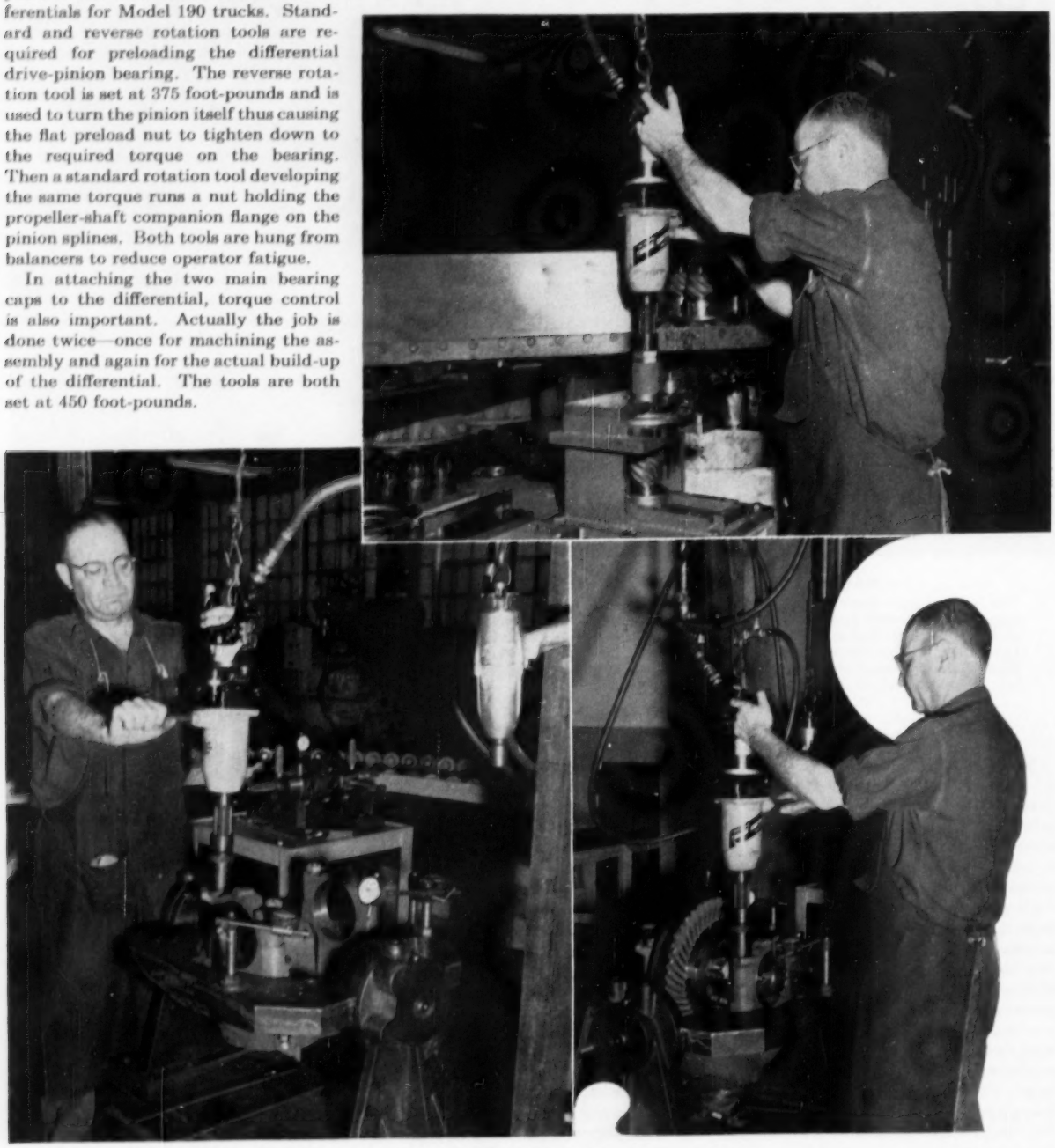
An Ingersoll-Rand size 5340T Torsion Bar Torque Control Impactool being used to run ten studs fastening the inner wheel of Budd duals to the hub. To put on the outer wheel, ten retaining nuts are run on the projecting threaded portion of the studs. A standard rotation tool set at 425 foot-pounds is used to run studs and retaining nuts on the right-hand wheel-and-hub assembly; a reverse rotation tool, generating the same torque, is used for the left-hand threads on the left-side wheels.

rotation for the right-hand threads on right-hand wheels; and another with reverse rotation for the left-hand threads used on the opposite side. Each is suspended from a tool balancer over the work station.

Four of the 5340T tools were recently put to work on the line that builds differentials for Model 190 trucks. Standard and reverse rotation tools are required for preloading the differential drive-pinion bearing. The reverse rotation tool is set at 375 foot-pounds and is used to turn the pinion itself thus causing the flat preload nut to tighten down to the required torque on the bearing. Then a standard rotation tool developing the same torque runs a nut holding the propeller-shaft companion flange on the pinion splines. Both tools are hung from balancers to reduce operator fatigue.

In attaching the two main bearing caps to the differential, torque control is also important. Actually the job is done twice—once for machining the assembly and again for the actual build-up of the differential. The tools are both set at 450 foot-pounds.

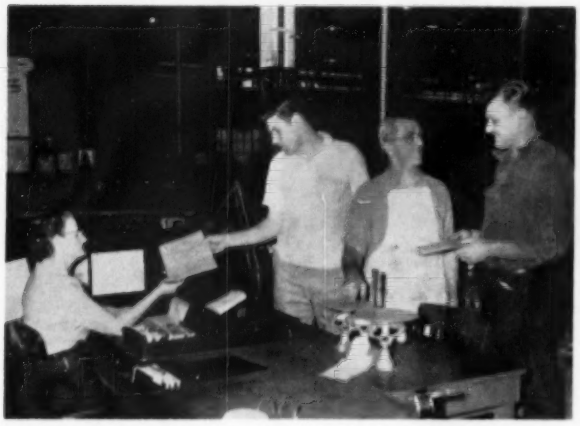
Torque settings on the tools are adjusted in the plant tool shop where they can be easily checked with special mechanical and hydraulic gauges developed at the Fort Wayne facility especially for that job. The setting and the specific task for which the tool is intended are stamped on a metal strip that is securely fastened to the tool. Torque values generated by the wrenches are periodically tested, but it has been found that once a tool is set, it continues to run nuts to the specified torque until the setting is deliberately changed.



ASSEMBLING DIFFERENTIALS

Four of the Torsion Bar Torque Control Impactools are in operation on the differential assembly line. The one shown at the top is a reverse rotation tool that turns the pinion thus causing a flat nut to turn down to the required torque (375 foot-pounds), and preload the differential drive pinion bearing. The next step in the operation makes use of a standard rotation tool to assemble the propeller-shaft companion flange to the pinion splines. The latter is also set at 375 foot-pounds and torque is maintained within 25 foot-pounds of the setting. At the left, a standard rotation tool is shown running down cap screws to 450 foot-pounds torque on the differential main bearing caps prior to machining the assembly under the same tension that it will be under when in service. After this, it is taken apart and another tool with the same setting (right) is used to put it together with the bearings and other parts in place.

Paper-Work Automation Aids Production Worker



BEFORE AND AFTER

At eighteen different areas throughout the General Electric Company's sprawling Detroit facility, scenes like the one, left, were frequent. Now, the automated timekeeper system (above) saves more than 1000 square feet of floor space and many man-hours. It represents an annual saving of about $36,000.

WHEN a production worker walks into General Electric Company's Metallurgical Products Department plant in Detroit, he speaks into a call box at his work station to report in and to give his clock, job and operation numbers to a central timekeeping office. There it is immediately key-punched into a tabulating card. Later when the worker finishes his first job, he again uses the device to report what he has accomplished as well as to give the details of the next job he is to start. This procedure is repeated every time a work change occurs so that at the end of the operator's shift, the central office can automatically balance his work against the actual clock hours. This, in essence, is a new, automated timekeeping system at work.

Installed almost a year ago in several buildings of the company's plant, the system, according to L. R. Butler who developed it and is manager of payroll and timekeeping, has already paid for itself three times over—an annual saving of about $36,000. Eleven workers were immediately released for other duties and additional man-hours have been picked up by eliminating "travel and waiting time" required under the formerly used method. The installation also brought about a saving of about 1000 square feet of floor space, and created an interesting and diversified job for the timekeepers in charge of the central office.

Most important, according to Butler, the system provides a faster flow of accumulated information to management and accounting departments. For example, it can spot machine down-time, detect unrealistic production piece counts, ascertain the status of work in process, determine perpetual inventories and record all completed jobs daily.

Under the old method, eighteen timekeepers, sprinkled throughout the plant in various departments, were required to record employee clock, job and operation numbers; data on work produced; and elapsed-time figures for each production voucher. The vouchers, in turn, had to be balanced daily with the workers' actual clock-card hours.

The old procedure also required the worker to check in and out with his timekeeper five or more times during his working day, thereby losing productive time, the amount of which depended on the distance, route and necessary detours between the working area and the timekeeper. Upon reaching his destination, the employee would often find the clerk occupied and would be forced to wait in line for service. The timekeeper himself, because of the spasmodic nature of the reporting, a result of varying

CENTRAL OFFICE

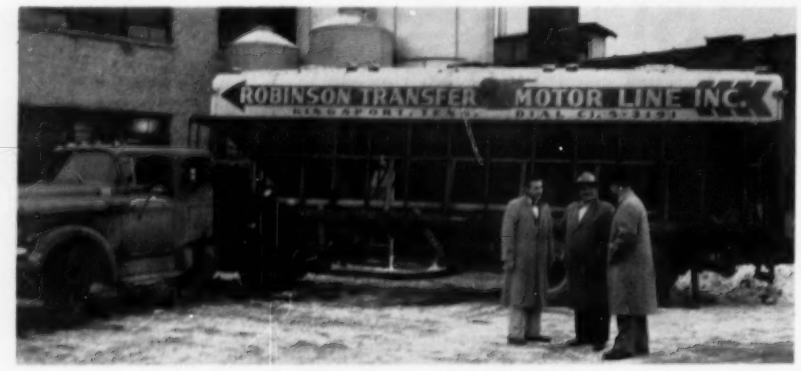
Working as fast as the radio network used by police communications departments and as automatic in tabulating and accumulating information as a chain store cash register, the central office, manned 24 hours a day, collects information on key-punched cards, integrates it with a master card and forwards it as a packaged group to the accounting unit. This office requires only seven girls as compared with eighteen needed in the previously used method.

production-completion schedules, frequently found himself without work.

The new 2-way communications, or audio-timekeeping system, changed all of this. Each call station is a contact with the central office. Boxes are strategically located within the plant according to the number of employees and the volume of job changes concentrated in the work areas. Each is no further than 60 feet away from any production worker. In the central office, three master sending and receiving sets make it possible for any call originating in the plant to be registered on the master control boards without delay. All the variable data are gathered on key-punch tabulating cards that are integrated with a master tabulating card, the latter containing prepunched rates and job information. This, in effect, presents a complete package to the machine accounting unit.

The Detroit operation, in many ways, is not a true production-line activity; rather, it is more similar to large-scale laboratory work. The equipment involved must be accurate, the materials must have the correct properties and must be available in sufficient quantities so that the workers can use their skills properly. Variables are bound to occur. A malfunctioning pill press or a temperamental sintering furnace require considerable effort to overcome on the part of the operator. To charge the ensuing delays to the employee did not seem fair, so the call-box system was devised. Now, with the information provided, variables can quickly be pin-pointed without penalizing the worker or questioning his abilities.

"Now what is it you want?"



BULK-CARRYING TRUCK

The bulk trailer (above) is made up of three airtight hopper units, all of which can be unloaded by a self-contained blower unit in approximately 6 hours. Behind the truck are two storage tanks at the Flex-O-Glass facility.

Airveying Reduces Costs

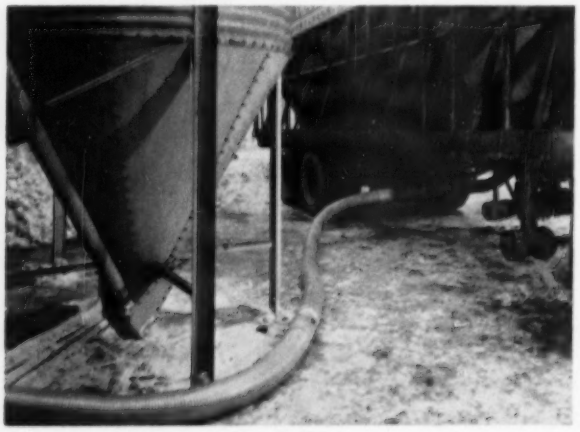
TO REDUCE materials-handling costs, Flex-O-Glass, Inc., of Chicago, Ill., is taking advantage of Eastman Chemical Products, Inc.'s bulk shipment of Tenite butyrate plastics. The reductions made possible by quantity handling, as pictured on this page, are attributable to several factors. Labor and equipment required to unload standard-type shipments are eliminated; after the hose connections are made, unloading is accomplished practically unattended. The use of large silos, tanks or bins minimizes the required storage area; and this concentration facilitates the transfer of material to processing machinery by air, gravity or mechanical methods.

BLOWER UNIT

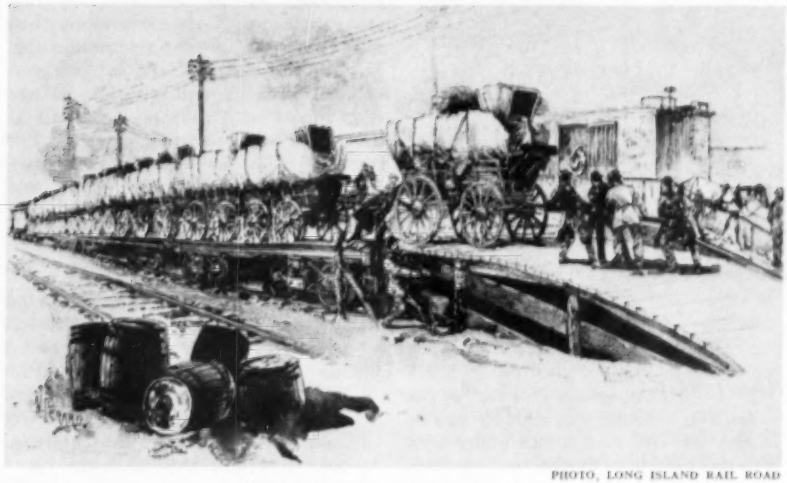
Air is supplied for the unloading operation by a 25-hp engine and blower, shown above, mounted at the forward end of the trailer. Each of the two large aluminum silos at the left has a capacity of 35,000 pounds. The Tenite butyrate plastic is being unloaded into them for storage. When it is needed, the material will be transferred directly from the silos to processing equipment by means of electric-powered screw conveyors.

AIRVEYOR

The center hopper of the transport trailer is shown (below) being unloaded through a 6-inch flexible hose. It consists of two 20-foot sections and is carried with the truck. Connections are quickly made to the filling line by a spring-loaded ratchet. Unloading of this single hopper section requires about 2 hours.



This and That



PHOTO, LONG ISLAND RAIL ROAD

EARLY PIGGYBACKING

Farm wagons, in the late 1800's, were carried into New York City on flat cars belonging to the Long Island Rail Road. It appears to be the prototype of today's piggyback operations. Farmers on Long Island, living 30 or more miles outside the metropolis, were thus able to compete with neighbors who lived nearer town. Although the service rate was so low that the rail company wasn't able to make a profit, it did benefit from a resultant growth in the outlying areas along its route. The picture above shows an unloading operation on a train of truck-wagons.

Leprechauns And Electronic Computors

Leprechauns, the little creatures of Irish lore, have invaded the electronic computor field. Their name has been given to Bell Telephone Laboratories' new digital computor. It is still in the experimental state; however applications for it are being found daily. Unlike its giant predecessors, the unit is about the size of a small refrigerator, but it contains, with the exception of its magnetic cores, 9000 electrical components. Because of its 5000 transistors, the device uses less power than a television set. It is said that specially trained personnel will not be required to operate the equipment because simple circuits are used.

* * *

Avian Architect's Tree House

Birds are not content to be left out of discussions about today's trends in architecture. One feathered creature in Fort Wayne, Ind., has gone so far as to design the perfect home. It will never wear out, is built with a material that is easily cleaned, is unusually strong, and will not corrode or rot. The wise creature has gathered tiny strands of stainless steel wire and made off with it to build a nest. The metal is supplied by Allegheny Ludlum Steel Corporation to Fort Wayne Metals, Inc., to make unusually fine filters for automotive and aircraft uses and special high-pressure cables.

* * *

Klamath Reclamation Project

One of the earliest federal reclamation jobs has completed 50 years of operation. Known as the Klamath project, it encompasses land areas in both Oregon and California and is located on the Klamath and Lost rivers. An irrigation project only—there is no federally developed power in the operation—water deliveries have grown to supply about 200,000 acres of abundantly producing land. In 1907 when the first water was delivered to irrigated farms, only 8900 acres were supplied. During the half century of its operation, the Klamath project has cost the government about $14 million, but $12 million of that has already been returned to the public treasury. On the basis of current prices, the land there has produced crops with an aggregate gross value of $450 million. In the area, project lands account for five-sixths of the gross crop income. The principal storage unit is Klamath Lake, the capacity of which was greatly increased in 1921 by the construction of the Link River Dam, built by the California-Oregon Power Company without cost to the government. The utility turned the dam over to the government on completion, but retains power rights at the project. The latter, however, are subordinate to water rights and in addition the firm granted the project a preferential power rate for the considerable power required for pumping operations in the project area.

* * *

Construction Monument Opened

Four years and 8 months after ground was broken, the Lincoln Tunnel's Third Tube, connecting the states of New York and New Jersey, was opened for traffic on May 25. Its construction was detailed in a pair of articles in COMPRESSED AIR MAGAZINE (September and October 1956). The tunnel has 2,500,000 individual 4¼-inch square ceramic tiles, or enough to tile every average bathroom in a 2500-home city; sufficient electric wiring to connect New York and California; and enough lighting to illuminate both sides of Broadway from the Battery, at the lower end of Manhattan, up a third of the island to Forty-second street. Although costs for the project neared the $100 million mark, its facilities, coupled with the two existing tunnels, are expected to double rush-hour capacity and increase the over-all capacity of the tunnels by 50 percent. Donald V. Lowe, chairman of The Port of New York Authority, commented on the subaque-

THE LAST BOLT

On June 28, 1956, Governors Averell Harriman (right) of New York and Robert B. Meyner (second from the left) of New Jersey, tightened the last bolt in the final ring of the third tube. In all, 30,000 cast-iron-and-steel segments weighing 40,000 tons make up the 2031 rings in the subaqueous shell.

ous project as a conquest of a mighty river and praised the construction crews for their excellent safety record. "For the first time in the history of underwater tunneling jobs of this magnitude, that portion of the tunnel which was built by sand hogs (a crew of 200), working in compressed air under the river, was completed with no loss of life".

* * *

New Use For Retired Gold Mine

Near Bad Gastein in the Salzburg Province of Austria, a train runs deep into a mountain gold mine, but its return trip does not bring the precious ore to the surface. The only riders are human beings in search of good health. Several trips are made daily and the patients who use the underground spa are under the care of doctors.

The mine was abandoned during the second World War because it did not yield profitable quantities of the metal. Later, mountain climbers, exploring the abandoned shafts, discovered that they felt relief from rheumatic and other similar ills after their long hours underground. Scientists, searching for a reason for this, discovered that the mine was full of radioactive emanations. It is now believed that they are caused by gases originating in vast, highly mineralized radioactive springs deep within the earth and escaping through crevices in the rock.

Ice Fog May Be Eliminated

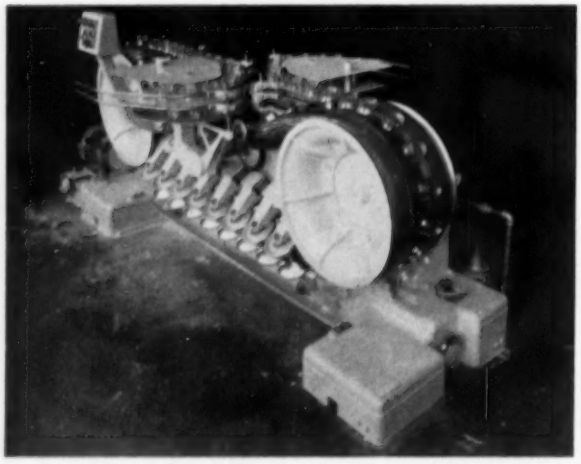
Man-made "ice fog" of the Arctic—caused by engine exhaust fumes—may be a thing of the past, according to research engineers at Armour Research Foundation of Illinois Institute of Technology. Ice fog results mainly from the exhaust of internal combustion engines and flue gases from power-plant chimneys. Both discharge large quantities of water vapor. Passed into the cold atmosphere, the vapor condenses into a wide range of translucent, irregular-shaped particles that cut visibility through a complicated system of light scattering, diffusion and transmission, varying with the size and concentration of the particles.

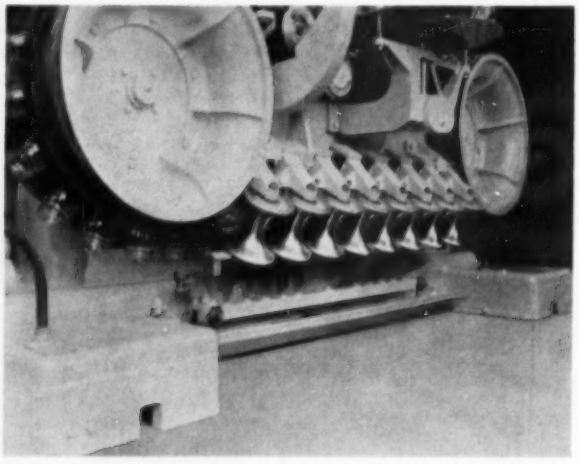
Using standards which considered the relationship of visibility to exhaust and temperature, the scientists developed an "eliminator" unit based on cooling and condensing, mixing, and then reheating the exhaust. Moisture content then falls below that needed to produce fog. In a working model, the exhaust was cooled and condensed to 40°F. It was then mixed with counter-heated air at a ratio of approximately 15 to 1. The resulting gases were mixed again by using the fan of the air-cooled engine, and reheated by an engine cylinder.

* * *

Catalyzed Nuclear Reactions

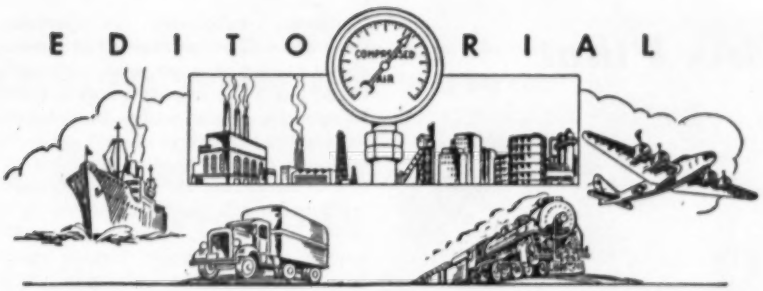
It has been announced that another method of releasing energy stored in atoms has been developed by Professor Luis W. Alvarez and a team of scientists from the University of California. Described as a catalyzed nuclear reaction, the technique is a "cold" fusion of hydrogen atoms. The process uses a nuclear particle—the negative mu meson—to pull together the core of a hydrogen atom and a heavy hydrogen atom, fusing the two into an atom of helium. The fusion takes place at any temperature, it is said, and releases twice as much energy as the fission of uranium. With further investigation the technique may lead to a sound way of developing nuclear energy, but at the present time one critical drawback stands in the way. The negative mu meson particles are very scarce and have an extremely short life, thus making the process economically impractical.





AIR AND NATURE CLEAN GLASS CONTAINERS

In a machine called Pneumaclean, designed by Pneumatic Scale Corporation, Limited, compressed air and the laws of nature cooperate in the cleaning of glassware and other fragile containers. A pair of softly resilient, heavy-duty neoprene tubes, inflated with air at 2-psi pressure, ride astride a standard platform chain conveyor (left). They grip the containers gently, yet firmly enough so that they are securely held as they are whipped around a pulley, in the foreground (right). Thus the bottles are inverted and in the process, centrifugal force has thrown almost all of the larger foreign matter from them. When the jars are upside down, gravity pulls out any remaining heavy substances. Next, the containers are carried over two sets of five air jets (above) operating at 60-psi pressure and using 25 cfm of air. There are fall-out spaces before, between and after the sets. All dust, lint and similar particles are blown from the jars and picked up by an exhaust fan. The cleaned pieces are carried up and over a second pulley, in the foreground (left), righted and discharged at a rate of 500 or more per minute, depending on their size. The equipment occupies a space of 45x113x42 inches and uses two motors: one, a 2-hp model for the main drive; and the other, of 1½ hp, for suction-fan drive. Direct connection into existing suction systems can be substituted.



MODERN ALCHEMY

MANY of us attended school when chemistry and physics, if taught at all, were represented as a series of firm laws, not the least of which was that the periodic table of the elements showed the existence of 92 elements, no more and no less. The periodic table still is an accurate and definitive explanation of elemental construction and chemical properties; however it is now apparent that it includes more than 92 elements. Indeed, it has now been extended to 101 and with careful work on the part of our atomic scientists the list may yet grow to 108 or even more.

The original periodic table was proposed by Dmitri I. Mendeleev (also Mendelyev) in 1869. Mendeleev refined his table during the ensuing years and by the turn of the century, it had assumed much the same form as it has today. It wasn't until the scientific breakthrough on the original atom-bomb project that elements 93 and 94 were discovered and their chemical properties determined. Actually the word *synthesized* would be a better term than *discovered*, because neptunium and plutonium, as they were named, were man-made elements—formed in his reaction chambers from uranium and its isotopes. Since then, in the cyclotrons and atomic piles of this country and in the debris resulting from atomic and thermonuclear explosions, seven other elements have been discovered. But it hasn't been accidental—our chemists and physicists have hunted them with sharp eyes and in all cases have known exactly what they were looking for. They knew because the periodic table reveals what chemical properties a given element should have.

The new group of elements belongs to a family, just as do the other elements in the periodic table, thus confirming and extending the basic theory. It is, in fact, their family resemblance that has made possible the creation, so far, of elements 95 through 101 and the prediction of at least two more—102 and 103 in the table. Scientists tell us that these new heavy elements closely resemble in their chemical properties the so-called rare earths, thus making it possible to guess in advance what form a new element will take. The rare-earth family begins with element 57—lanthanum—and runs to element 71—lutetium. The group takes its name—lanthanides—from the first element in the series. The new man-made elements belong to the family called actinides, which similarily takes its name from its first element, 89, actinium. The group then progresses through thorium (90), protactinium (91), uranium (92), neptunium (93), plutonium (94), americium (95), curium (96), berkelium (97), californium (98), einsteinum (99), fermium (100) and mendelevium (101), as well as 102 and 103 that won't be named until they have been synthesized.

The naming of each of the new elements has something of a story to it. The first two in the man-made series were called neptunium and plutonium because of the analogy that exists between their discovery and the finding of Neptune and Pluto, the eighth and ninth planets of our solar system. Most of us are aware of the fact that the existence of the two planets was predetermined by analyzing seeming irregularities in the movement of other bodies in the system which could be explained only by the presence of additional planets. Similarly, scientists were confused by the abrupt break-off of the known elements at uranium because of its position—one seemingly in the middle of a periodic group. They reasoned that more might exist, even though they didn't occur naturally on earth.

Americium was named after the new world because of the long search which preceded both the discovery of this continent and the new element. Curium was named after the Curies who founded atomic chemistry by their work with radium. To find the reason for naming berkelium, we must compare the new group to the rare earths. Terbium, the element in the latter group that corresponds to element 97, was named for the town of Ytterby in Sweden where it was discovered. Because element 97 was made in the laboratories of the University of California at Berkeley, it derived its name from the city.

In naming Number 98, the discoverers thought of following the precedent set in the rare earth group, but then discarded the idea in favor of naming the element californium after California. In reporting the isolation of the new element in *The Physical Review* they announced: "The best we can do is point out, in recognition of the fact that dysprosium (*The rare earth analogue of number 98*) is named on the basis of a Greek word meaning 'difficult to get at,' that the searchers for another element a century ago found it difficult to get to California."

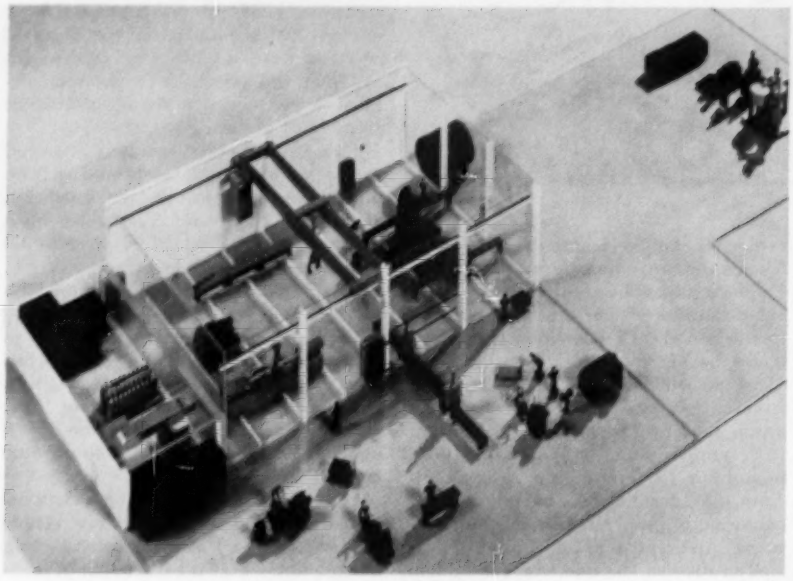
'Elements 99 and 100 were discovered in the radioactive debris resulting from a thermonuclear test in the Pacific in November 1952, and have since been synthesized in a cyclotron. Number 99 was named einsteinum in honor of Dr. Albert Einstein, whose Theory of Relativity unlocked the door to atomic science. As a scientific monument to the work of Dr. Enrico Fermi, who has been called the father of the atomic age, 100 was entitled fermium. The 101st element was named mendelevium in recognition of the originator of the periodic table, Mendeleev.

It is interesting to note that scientists judge it impractical to isolate visible quantities of any element heavier than einsteinium—that the discovery of mendelevium and any others farther up the scale was and will be done by finding, not the elements themselves, but by looking for the radioactive energy omitted when they decay or break down into lighter substances. The scientists that discovered element 101 announce that it is now possible to produce about 100 atoms of mendelevium at a time and point out that this quantity wouldn't even be a drop in a bucket so small that it were invisible. It is a tribute to the delicacy of the equipment used by our physicists that such measurements, if they can be called that, can be made, or that atoms can be counted.

The question naturally arises as to the value of all of this if it is impossible to produce enough of any of these elements for use either in weapons, or as all of us would prefer, in some labor-saving device that could work for peace. It should be pointed out that most of the pure scientific discoveries so far made have found gainful employment in one way or another and it is to be expected that the synthesis of elements at the top of the periodic scale will also be useful, if only because it increases our understanding of the world we inhabit.

Synthesis of new elements is not the only attempt at alchemy. Scientists also have come up with many previously unknown isotopes. An isotope is one of two or more species of the same element. Related isotopes have the same atomic numbers, thus occupy the same spot in the periodic table, but differ in atomic weight. Many are radioactive and because they react chemically the same as their non-radioactive counterparts, often can be used as tracers of chemical reactions.

No Air in This Plant



IN-FAB PILOT PLANT

A model of the Bridgeville, Pa., facility, and the equipment it will house. The vacuum arc furnace is on the extreme right.

TO OVERCOME difficulties encountered in working certain metals at elevated temperatures in the presence of air, Universal-Cyclops Steel Corporation is building, at Bridgeville, Pa., a room that will have its own atmosphere of inert gas. It will contain a vacuum melting furnace to produce ingots, and forging and rolling equipment for forming shapes from them. Molybdenum will be the first metal worked, but other refractory types will probably follow.

The airtight room will be 42x100 feet with a 25-foot ceiling. All those entering it will wear "space suits" with connecting hose lines from manifolds to deliver fresh breathing air and take away exhalations. As a safety measure, each suit will have an auxiliary air supply sufficient to get the wearer safely out of the plant in case of an emergency. There will be three air locks: one for equipment, one for supplies and one for personnel. The first two will be of the conventional tunnel type with tight-sealing doors at either end and equipment to withdraw the air from between them. The personnel lock will have two doors lined with diaphragms conforming closely to the shape of the human body.

A novel method is proposed for initially filling the room with inert gas. A sufficient number of balloons will be inflated with the gas inside the room to fill practically all the space and will then be punctured, thus driving out the air. The last traces of normal atmosphere will be removed by absorption with a "gettering" substance. In operation, the room will be maintained at 1 ounce above atmospheric pressure, with additional gas being introduced as required by releasing it from tanks. It is planned to keep the percentage of inert gas in the enclosure at 99.98 percent or higher.

A General Electric vacuum arc-melting furnace will handle ingots up to 16 inches in diameter, 5 feet long and 5000 pounds. The principal forging equipment will be a Chambersburg Impacter, an air-operated hammer, that works horizontally instead of vertically. Ingots will be heated in an induction furnace in the base of the hammer then raised into the striking zone and reduced into billets or sheet bars. A 16-inch Birdsboro blooming mill for turning out rolled products and a lathe, shear, backsaw and welding unit will complete the equipment.

Molybdenum, which has good strength and other favorable characteristics for potential high-temperature applications, melts above 4700°F. In what is called the "hot" work zone (3500-4000°F), it oxidizes fast and at "warm" work temperatures (around 2500°F) it becomes brittle if even minute quantities of impurities are present. Because of these shortcomings, working of the metal and its alloys has been restricted to the cold and warm zones. Whenever it has been worked at above 2500°F, it has produced an oxidation smoke screen and its ductility has decreased rapidly.

The new plant, called "In-Fab" (short for inert fabrication), is designed to permit working the metal at high temperatures without incident oxidation. It is actually a pilot plant intended for experimentation. If favorable results are obtained with molybdenum, similar tests with titanium, zirconium and perhaps nickel-bearing steel will be made. The Facilities Branch of the Navy Bureau of Aeronautics is coöperating in the movement. Work along the same general lines but with less adequate facilities has been carried on by Climax Molybdenum Company, the Atomic Energy Commission and Battelle Memorial Institute.

Air-Lift

A HIGH-CAPACITY storage unit for parts or blanks that can roll has been developed by Gear-O-Mation Division of the Michigan Tool Company. Its operation is entirely pneumatic and the design gives true demand-feeding from a controlled mobile storage medium.

Parts are guided through a silhouette accept-reject device to fully caged double threads, or tracks, and gravity fed to a push-type elevator, working in conjunction with a stroke-lift pneumatic piston. Lifting speed can be varied by means of a closed-circuit hydraulic cylinder coupled to the air cylinder.

As the parts leave the top of the elevator, they are gravity rolled through the circular tracks to the exit chute. Air-operated gates control the movement of the part on demand. If stacking of blanks is desired, the static weight of the parts mechanically moves air valves that cause gates to open or close. The device automatically stops when full.

THE STORAGE UNIT

The equipment illustrated is handling ring-gear blanks for a broaching operation, and has a storage capacity of 300 parts. The blanks enter from the rear, are raised by the enclosed pneumatically actuated elevator at the right, and are discharged from the top. From there, they roll down between two tracks and are either discharged or stored.

SAVING WITH AIR POWER

Cold Riveting Increases Production

AROUND each train window of a southern railway company's observation, dormitory, dining and coach cars, there are 96 rivets, 3/16 inch in diameter and ½ inch long. Each car has 16 windows. In the past, hot riveting methods were used and placing the fasteners on a single car required four men working 2 days. One worker tended the furnace and tossed the rivets, another caught them and the third drove them while the fourth employee bucked them up.

Today, a cold riveting process is used. Savings of $84 per car are realized because two men can do the same job in 1 day. They use an Ingersoll-Rand Size AR260 Air Buck Riveter. Although one man could handle the work, it has been found that two are more efficient; the men on the outside can more readily insert the rivets, and at times it is necessary to use temporary screws to pull up the frames prior to riveting.

COLD RIVETING

Four men were once needed to hot rivet train windows for a southern railroad. Using the cold riveting process demonstrated above, two men can complete the job in half the time. The man on the outside inserts the fasteners. Together they can run 1536 rivets in 1 day, saving the company $84 per car.

FREON-JET AIR SAMPLING HOOKUP

A great variety of equipment based on the familiar steam-jet principle has been evolved. The gadget shown in this picture is one of the latest of these and is an air sampling device that collects any impurities or dust in atmospheric air, depositing them in a test fluid. The job formerly required a bulky hand-operated air pump and other heavy equipment. Designed by E. I. du Pont de Nemours & Company, this device uses the flow of Freon through a jet orifice in an aspirator to collect air and force it through an impingement chamber and bubble it through a liquid trap in which impurities are caught. Analysis of the liquid then reveals the dust and dirt content of the air sample. This device may be worn by a worker in any job and the air sample, for example, can be drawn through a tube pinned to his collar, thus assuring that the air sample is representative of the air he breathes. The gas used is the same as that in many pressure-packed food and paint packages.

Elevators Celebrate Centennial

VERTICAL transportation of people is a youngster compared to that of hoisting devices in general. One hundred years ago, E. V. Haughwout & Company, at a cost of $300, installed the first passenger elevator. It was designed by Elisha Otis. The lift included a safety device that had been invented 5 years earlier and that consisted of nothing more than pawls on the car to catch a rack along the shaft in the event the hoist rope snapped. The vehicle, driven by belts from line shafting, had a speed of 400 feet per minute.

Electricity for powering elevators was first used in 1887 and became standard just before the turn of the century. By 1907, direct connection was made to the motor. Development has continued to a point where, since 1950, approximately three quarters of elevator installations specify automatic, self-service models. Without Otis' invention, and such subsequent improvements as the advent of hydraulics in 1878, the now familiar skyscraper would have been impossible.

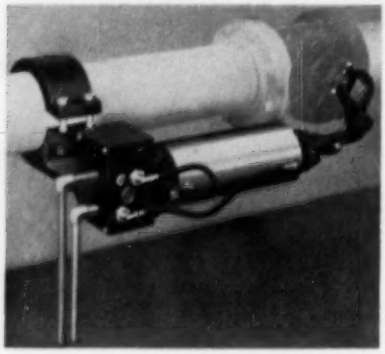
It is interesting to contrast figures published in COMPRESSED AIR MAGAZINE of April 1909 with those available today. In the early issue, it was reported "that in the Borough of Manhattan there are about 10,000 passenger elevators. . . . In 26 office buildings of eighteen stories and more, with a rentable area of 116 acres, there are 231 elevators that travel between 4000 and 5000 miles of vertical distance each day and carry 615,000 passengers." The article continued to say that officials of the Otis Elevator Company expected that by 1953, 23 billion people would ride 550 million miles in its elevators throughout the world.

In 1927, the number of people transported in a year had reached beyond the 33½-million mark and in the early 1950's, the 110,000 lifts in service in the United States alone carried an estimated 22 to 25 billion passengers annually. Those curious about safety records will be interested to note that during the same period of time, only 10 fatalities were reported, a figure of only 1 death in 2 to 2½ billion. By a passenger-mile, the comparison rate would be even less significant.

"I said 50 feet long!"

Industrial Notes

Featuring positive, complete closing and opening, Pantex Manufacturing Corporation's plug valve actuators have wide application in power plants, water works, chemical factories, oil refineries and tank farms. They are said to be built for dependable, heavy-duty service life and are available in packaged as-



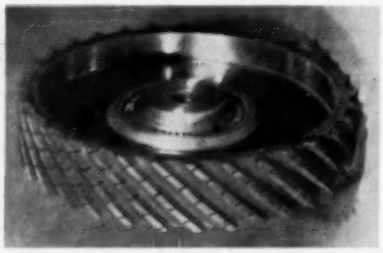
semblies that are delivered ready to attach to pipes and plug valve stems. Units are available in 1- to 8-inch pipe sizes and designed to fit all popular makes of plug valves. Ten- and 12-inch varieties are under development.

Circle 1E on reply card

Tapered feed-adjustment screws allow simple, more accurate feed control in Trico Fuse Manufacturing Company's multiple-feed oiler. Conventional lock nuts are not necessary because each screw has a snug, leak-proof, friction fit. Therefore, finger-tip control is possible—wrenches are not required. The unit features a large-size filler cap for easier refilling. Special neoprene-and-cork cylinder gaskets are said to provide permanent leak-proof reservoirs. They are available with manual or electric solenoid control, in 1 to 24 outlets and with 10-ounce, 1-pint, 1- or 2½-quart-capacity reservoirs made of Pyrex glass or shatter-proof Lucite.

Circle 2E on reply card

A rubber contact wheel that reportedly has increased abrasive-belt service life by 40 percent has been developed by Minnesota Mining & Manufacturing Company for use on backstand grinding and polishing operations. Because of a slashed serration, the wheel has wider-than-usual lands to provide more rubber surface; and at the same time, does not sacrifice conformability or aggressiveness. It is available from the Chicago Rubber Company in a 14-inch diameter with 1-, 2-, 3- and 4-inch face widths, and is suitable for applications in off-



hand weld removal, grinding, polishing, snagging and finishing fabricated metal parts. *Circle 3E on reply card*

Boring speeds of Hydrauger horizontal earth-boring machines have been increased as much as 40 percent according to the manufacturer. This is said to have resulted not only from its redesign but from an incorporation of a high-torque Ingersoll-Rand Size 55L Multi-Vane air motor, specially built for the service.

The Hydrauger is classed as a wet hole machine: water, forced through the hollow steel boring bar sections, cools the cutting bit, washes cuttings from the hole and muds the hole walls. Water cooled bits, it is claimed, drill farther between redressings than other types, and cool bits enable operators to gain full advantage of high-torque air motors. The use of air power below the surface is also said to be less hazardous to workers than electric or gasoline power plants. Hydrauger machines are now available in several new sizes and modifications. The larger machines bore holes of 2 through 24 inches in diameter for distances up to 250 feet.

Circle 4E on reply card

For cutting round gaskets from asbestos, rubber, fiber or cork sheets, The Garlock Packing Company has designed Set B. It is a precision tool that features

a hexagonal-shaped bar on which are mounted knife and point holders. The device is adjustable to cut gaskets from 1¼- to 22¼-inch outside diameter and provisions can be made for cutting larger ones. *Circle 5E on reply card*

Two pneumatic stapler models, Nos. 32 and 52, have been developed by Swingline Industrial Corporation. The former provides a lightweight fastener of 0.02x0.05-inch wire, and the latter, a heavy one. Each forms and drives a ⅛-inch crown staple with ⅜-, 7/16 or ½-inch leg length, depending on the cartridge used. The fasteners are formed from a flexible belt of precut wire lengths, coiled in a compact, expendable plastic magazine. Reportedly, more than 5000 of them can be driven with a single loading. An air reservoir in the pistol-type grip assures continual operation in the event there is a temporary air-pressure drop. A rubber seal between its piston and cylinder wall prevents wasteful bleeding of air and eliminates wear between rubbing metal parts. Because they are com-

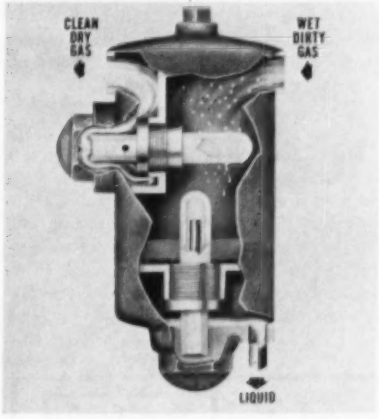
pact, the tools can be used with remote control for gang assembly-line production as well as to reach inaccessible places. *Circle 6E on reply card*

For protection of threads and sockets as well as external surfaces, W-S Fittings Division of H. K. Porter Company, Inc., has added a blue coating to its forged carbon-steel fittings. This is said

to provide an excellent base for paint in cases where pipelines should be painted for color-coding or rust-preventive purposes. Fittings available with the coating include sizes ⅛ to 4 inches in 2000-, 3000- and 6000-pound, screw-end types and schedule 40, 80, 160 and XX socket-welding types.

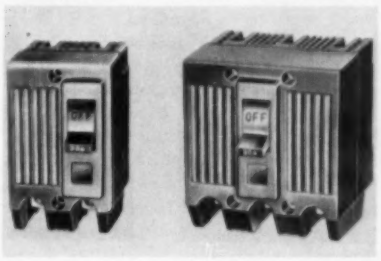
Circle 7E on reply card

Liqui-Jector, a liquid-gas separation device for removal of entrained liquids and solids from air, gas and steam systems is available from Selas Corporation of America in twelve standard sizes. Formerly it had been a specially built item, and although the fixture has been standardized, the manufacturer states that models for unusual situations will continue to be made to order. It provides clean dry air for operating pneumatic equipment and control and recording instruments. The unit operates by phase separation; that is, trapping solids first and then passing liquid in one direction and gas in another without interrupting flow through the line. Maintenance costs are said to be reduced to a minimum because there are no moving parts, no extra pipes or special fittings. The device can be installed against the wall or in-line with any normal piping. Three models are available: Series A (illustrated) for volumes to 100-scfm (surface cubic feet per minute) gas at 150-psi pressure, Series B for volumes to 7000-scfm gas at 200 psi and Series C for conditions where unusually large volumes of condensate are encountered.



Circle 8E on reply card

General Electric Company's Circuit Protective Devices Department has announced compact, 240-volt, plug-in circuit breakers for lighting and power circuits from 15 to 50 amperes that are half the size of the conventional E-frame models. With the addition of these units, the original TQL line is expanded to include 1-, 2- and 3-pole devices for 120-, 120/240- and 240-volt a-c applications. Switching-neutral and isolated-terminal plug-in breakers complete the line. It is said that any G-E plug-in

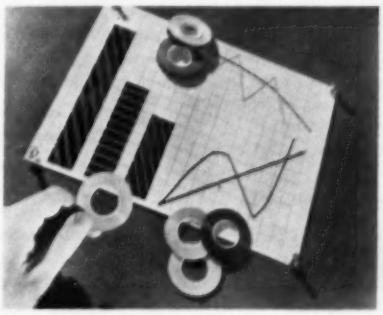


breaker fits any of four types of enclosures and panels, thus achiving flexibility without obsoleting equipment.

Circle 9E on reply card

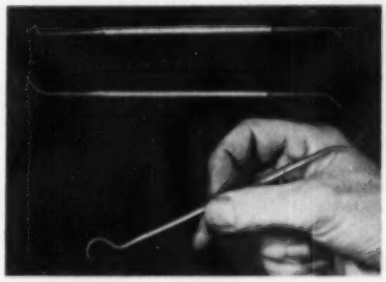
A line of custom-made fluidization (dip coating) units for applying industrial corrosion-resistant coatings has been announced by American Agile Corporation. They provide the largest facilities yet available for dip coating irregularly shaped targets with polyethylene, nylon and fluorocarbons. The devices are available in square, cylindrical and rectangular shapes; and in sizes ranging from 15 inches in diameter and 6 feet in depth in the powder bed, to those measuring 4 feet square and 40 inches deep. Compressed air is required to fluidize the coating powders and is introduced through the air inlet in quantities ranging from 2½- to 3½-scfs (surface cubic feet per second). All models are equipped with auxillary blower assemblies to aid in the fluidization in situations where existing compressed-air volume is not sufficient. *Circle 10E on reply card*

For personnel concerned with making charts, graphs and similar representations, American Chart Service, Inc., is offering a pressure-sensitive plastic tape. It is available in fifteen colors, six widths ranging from 1/32 to 1 inch and in nine different designs. Each tape is wound on an Aeroflex core made by Anchor Plastics Company to permit low-friction dispensing from mandrels and damage-protecting flexibility when rolls are squeezed or misused. Each tape comes in a polyethylene bag to keep it dirt free and to preserve the adhesive. They can be rapidly applied to almost any surface, and the narrower varieties can be easily curved. According to the company, charts may be changed by merely lifting the tape and replacing it in a new location.



Circle 11E on reply card

Wherever assemblies and operations approach miniature or subminiature, multiform needle ends and non-skid handles, of modified dental instruments designed and imported by A. Lawrence Karp, prove effective in manipulating, manual sensing, grinding, selecting, assorting and even lubricating, wherein droplets of oil are rolled down the tine



into remote bearings and joints. A set of three double-headed Dentools, as they

UTILITY LANTERN

Burgess Battery Company has developed a rugged, all-purpose sportsman's utility lantern. It is said to be the first designed with a focusing lighthead mounted on a double-powered dry battery which is its own case. By adjusting the outer focusing ring of the oversized all steel lighthead, the lantern can be changed from a narrow spotlight that carries about a half a mile, to a broad-beam floodlight. It features a steel, distortion-proof reflector coated with vaporized aluminum to increase the intensity of the light beam and prevent tarnishing or peeling. The "Bearcat", as the lamp is called, is designed for fishermen, hunters and campers as well as for heavy-duty industrial, highway-emergency, home, farm or general outdoor illumination. With battery, the lantern will retail for $6.95.

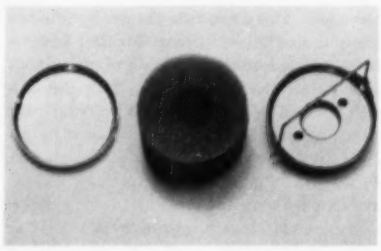
are called, represents an assortment that will accommodate varied industrial and mechanical applications. Because these devices are unit-forged, they will reportedly withstand considerable abuse and will inexpensively add to the range of existing tool assortments.

Circle 12E on reply card

Four-wheel drive and finger-tip direction controls are featured in the Ranger-200, a 20,000-pound capacity, pneumatic-tired fork truck, designed by the Industrial Truck Division of Clark Equipment Company. Four-speed, power-shift transmissions, a torque converter with 3-to-1 multiplication and a 143-hp General Motors diesel engine reportedly suit the unit particularly for heavy-duty work in mud and over rough terrain. A selector switch adapts the truck to 2-wheel drive. The unit has an under-clearance of 14 inches, a turning radius of 312 inches and a 108-inch wheel base. A single lever on the steering column controls lifting and tilting movements. Power steering is standard.

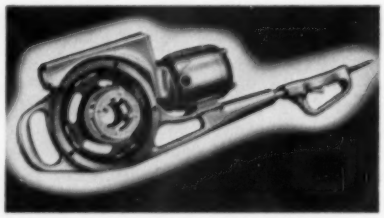
Circle 13E on reply card

Power Products Corporation has developed an air cleaner that consists of a polyurethane foam plastic that has been treated so that it is soft and sponge-like. This element is held tightly between a base and cap. As air passes through it, small particles are trapped and large ones are shaken loose by natural vibration. As the filter becomes clogged, its amplitude of vibration increases, indicating to the operator the need for cleaning. It is then disassembled, without tools, washed in water and reassembled for operation. The fixture can operate at any angle because no oil reservoir is used, and according to the company, it is not affected by temperatures of normal engine operation.



Circle 14E on reply card

For pipe and conduit threading, pulling, lifting, turning and wherever portable power is required, The Toledo Pipe Threading Machine Company's No. 68 portable power drive can be used. Basically it is a worm-and-ring gear assembly



housed in an aluminum frame. According to the manufacturer, power can be supplied by a ½-hp, 110-volt motor or by a 90-psi-pressure air motor.

Circle 15E on reply card

Duroil air drill hose is the name given to a hose for pneumatic rock drills. Developed by Hewitt-Robins, Inc., it is light and flexible for easy handling, yet tough enough for use in such heavy-duty applications as quarry work, mining and road construction. It is available in 500-foot reels, in ½-, ¾- and

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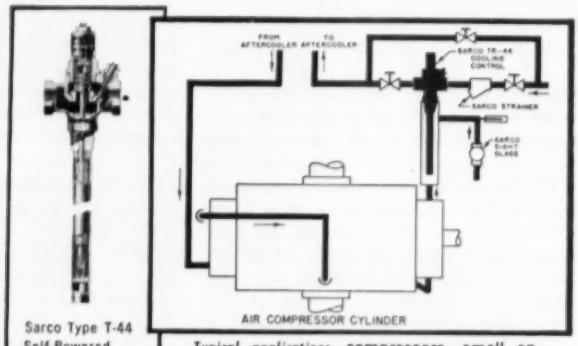

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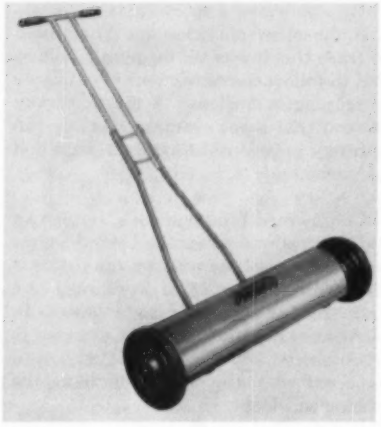
SARCO

Circle 11A on reply card

1-inch diameters, and reportedly has a tensile strength in excess of 2000 pounds per square inch. Lined with Buna N tube, it is resistant to oil and oil vapors, and its braided rayon-cord carcass will not contract, elongate or "fight back" under working pressures.

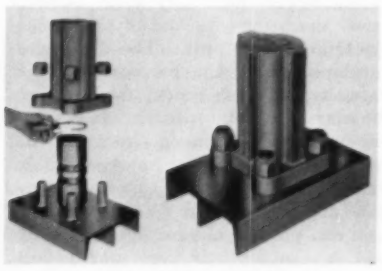
Circle 16E on reply card

A permanent-magnet-type hand sweeper for picking up nails, metal shavings and similar ferrous scrap has been designed by The Homer Manufacturing Company, Inc. Available in 12-, 18-, and 36-inch widths, the device features a cast main housing, lightweight handles with plastic grips and semipneumatic tires. Reportedly it has great maneuverability and can be easily cleaned.

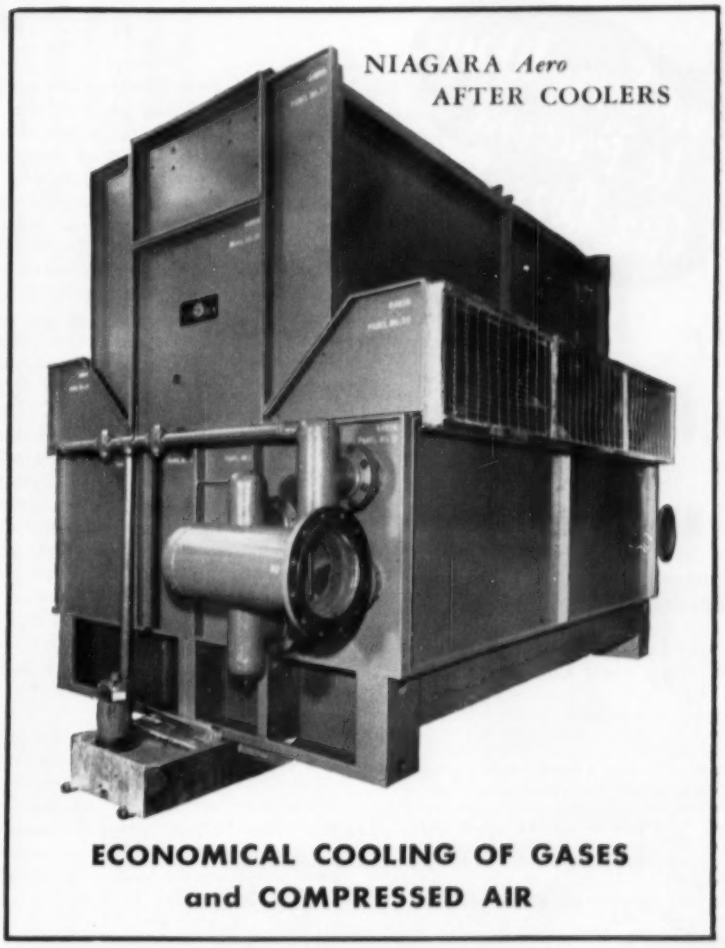


Circle 17E on reply card

A 2-port vibrator, called Type KO, has been designed by Cleveland Vibrator Company. It consists of a steel piston housed in a cast aluminum or semisteel cylinder block. The assembly can be bolted either directly on a bin or to a base plate that has been welded on the container. Because the fixture is permanently lubricated with a dry film lubricant, molybdenum disulphide, easy sliding and minimum friction is provided, thus reportedly extending the unit's service life. They are available in 2- and 4-inch sizes, weighing 13 and 79 pounds, respectively. It has been used satisfactorily in moving such bulk materials as cement, grain, chemicals and coal through bins, chutes, hoppers and tubes.



Circle 18E on reply card



ECONOMICAL COOLING OF GASES and COMPRESSED AIR

● Cooling gases or cooling and removing moisture from compressed air, the Niagara *Aero* After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point close to the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large supply cooling water, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight and installation labor and in the expense of upkeep.

Niagara *Aero* After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

Write for Descriptive Bulletin 130

NIAGARA BLOWER COMPANY

Dept. CA-7, 405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

Circle 12A on reply card

"AIR KING"

Quick-Acting

HOSE COUPLINGS

For All Hose Connections

These plain rugged couplings are your surest safeguard against loss of air at the hose connections. Universal locking heads, on sizes up to 1", snap together to form a secure lock that is leakproof under pressure; in fact, pressure must be released before coupling can be disconnected. Ideal for rough outdoor work as well as indoor shop and plant service. Malleable iron, cadmium plated, and bronze. Hose Ends, Male and Female I.P.T. Ends. Size range, ¼" to 1". Also available in 4-lug type, not universal, in 1¼" to 2" sizes.

"BOSS"

Self-Honing

AIR VALVES

For the Entire System

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug. Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug within the valve body. Male or female thread both ends, in sizes ¾" to 1½".

Stocked by Manufacturers and Distributors of Industrial Rubber Products

DIXON
Valve & Coupling Co.

GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.
BRANCHES—CHICAGO · BIRMINGHAM · LOS ANGELES · HOUSTON
DIXON VALVE & COUPLING CO., LTD., TORONTO. Associate Companies:
Buck Iron Company, Inc., Quarryville, Pa. · Precision Drawn Steel Company, Camden, N.J.

BRIEFS

A low-cost leak detector that senses and locates a seepage so small that it admits less than 2 cubic inches of gas per year has been developed by NRC Equipment Corporation. The halogen-sensitive instrument is connected to a system or part under test and is then evacuated with a mechanical vacuum pump. When a pressure of 80 to 200 microns is attained, the outside of the part is blanketed with a tracer gas, Freon-12. If a leak is indicated, further probing with a fine stream of gas pinpoints it.

●

Miss Mary Isolen Fergusson has received the distinct honor of becoming the first female full member of Britain's senior engineering society—the Institution of Civil Engineers. Member Fergusson has been responsible for the construction of bridges, buildings and river purification schemes valued at more than 2 million pounds sterling. There are four other women on the roll of the Institution, none of whom have attained full membership status.

●

Twenty-two American educational institutions have received grants-in-aid totalling $2,170,350 to equip laboratories for training nuclear scientists and engineers. The Atomic Energy Commission made the awards as part of its program aimed at solving the manpower shortage in the atomic energy field.

●

By leasing an electronic "brain," Los Angeles County, Calif., estimates a monthly saving of about $42,000 more than the monthly rental figure of $47,305. The installation of Datamatic Corporation's model 1000 electronic data-processer is the first of its kind to be used in county governments.

●

Helihomer is one of the oil industry's newer navigational devices. It is a high-frequency instrument that consists of a transmitter on an off-shore drilling rig that sends radio waves, and a receiver in the cockpit of a helicopter that picks them up. This signal guides the pilot directly to the landing platform.

●

A giant transfer machine, 120 feet long and occupying a 5000-square-foot area, is in operation at the Dayton, Ohio, Chrysler Airtemp plant. The machine turns out an air conditioner compressor every 38 seconds.

●

In 1911, Captain R. F. Scott laid down a cache of supplies in the frozen wastes of Antarctica, intending to pick them up on his return trip from the South Pole. Captain Scott reached the pole, but he and his four companions perished before reaching the provisions. Recently, Peter Scott, son of the famed explorer, opened a number of tin cans from his father's cache, which was discovered several months ago. He found, for the most part, that the food was not only edible but still tasty. The only supplies not in good shape were the cans of evaporated milk which had curdled. The containers were opened at the Tin Research Institute in England in the presence of tin technologists and canning experts.

●

According to a survey, for every 298 automobiles, trucks and buses in the United States, there is one service station.

●

Radioactive particles are being used to trace the flow of oil through pipelines and to follow the movement of catalysts in refining operations. A recent survey showed that these agents are saving the industry between $140 and $215 million per year.

●

Commercial enterprises, industries and institutions across the United States will soon be able to rent air conditioners as they now rent office machines, cars and trucks, according to Herbert B. Wolf, president of Leasing Corporation of America. By the end of 1957, it is expected that 100 cities will have the leasing service.

●

All those who have felt that paperwork makes up more than its share of our daily business life have some additional ammunition to use as parting shots. It is estimated that the United States accounts for some 60 percent of the world's consumption of paper, using up about 400 pounds per year per person. Sweden uses about 230 pounds per capita, while the average Frenchman uses only one fourth of the U. S. figure. India and China have a per capita consumption of slightly more than 1 pound.

●

Vacuum sweepers of giant size are being used to hasten the work of Mother Nature in California where last year spotted alfalfa aphids caused an $11 million damage to the forage crops. Since the aphids seem to be developing an immunity to commonly used insecticides, another means had to be devised to eliminate the pest. The apparatus developed to do the job consists of a horn-shaped wind tunnel mounted on the rear of a pick-up truck. It gathers the natural parasite enemies of the aphids and quickly transports them in sacks made of organdy to areas where they are needed. In 20 minutes, two men can put the cleaner into operation and in another half hour, can collect 50 million of the parasites.

Industrial Books and Literature

Ingersoll-Rand Company's recently redesigned line of circulating and coolant pumps for sidewall or immersion mounting are described in Form No. 7444. The units have no stuffing boxes, pump bearings or couplings. Their long shaft construction plus the fact that vent holes are placed high in the supporting head permit high liquid levels. Sidewall mounted units are built in ¾-, 1- and 1½-inch sizes with single discharge, and ¾- and 1¼-inch dual discharge varieties. The horsepower range is from ¼ to 5 with capacities to 180 gpm at total discharge heads up to 90 feet. Immersion types are built in ¾- to 3-inch sizes in a range of ¼ to 10 horsepower. The latter are rated at up to 500 gpm against heads of as much as 160 feet.

Circle 19E on reply card

A History of Mechanics by Rene Dugas, first published in 1950 in French, has been translated into English. Although it presupposes an extensive mathematical background on the part of the reader, it is clear and authoritative. It is said to be the first single volume from which it is possible to learn what rational mechanics really is. Divided into five parts, the first describes the origins of mechanics from Greek civilization to 1600. The second traces the formation of classical mechanics; the third, the eighteenth century and the fourth deals with the nineteenth century. The final part details the principles of modern physical theories of mechanics, including those in the areas of relativity, wave mechanics and quantum mechanics. Copies of the volume may be ordered directly from Central Book Company, Inc., 261 Broadway, New York 7, N. Y. Price $15.00.

Publication of Investment Casting Institute's *Engineering & Design Manual* has been announced. It represents complete and authoritative information on the investment casting process and is a culmination of more than 2½ years of combined efforts on the part of various institute committees. The 50-page manual has been designed to aid industry to more clearly understand the advantages and limitations of the process and should be of value to design engineers, metallurgists and purchasing men.

One section of the book presents rules governing design, dimensional tolerances and shapes. Others cover surface finish, functional and general tolerances, radii, straightness, flatness, concentricity, roundness, angles, length, parallel sections, blind and through-going cores, threads, airfoil contours, etc. Details are given for both the lost-pattern and frozen-mercury phases of the processes,

HIGH efficiency...
LOW COST...
the BANTAM CRAWLER-MOUNTED BACK-HOE
with
CONTINENTAL RED SEAL POWER

C-35 Crawler Bantam's long reach enables the operator to spot overburden away from the trench, while the new narrow design of Bantam's gooseneck boom improves visibility, speeding the work. Built by Schield Bantam Co., Waverly, Iowa. Engine: Continental Red Seal F-186.

Famous Schield Bantam equipment is another notable example of the fine results to be achieved by tailoring the engine to its job. With Schield Bantam, as with other leading makes of power equipment, each Red Seal used has been engineered and built expressly for its work. Whatever the machine . . . whatever its job . . . you can bank on it for abundant power at the speeds consistent with low fuel and upkeep cost.

CONTINENTAL SERVICE AND GENUINE RED SEAL PARTS AVAILABLE THROUGHOUT THE WORLD

●

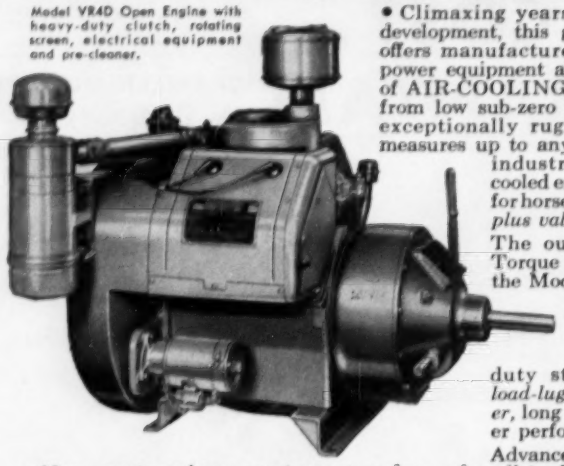
WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES, CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation
MUSKEGON • MICHIGAN

Circle 14A on reply card

Introducing the NEW, BIGGER 56 HP.
Model VR4D WISCONSIN
4-CYLINDER *Air-Cooled* ENGINE...

Model VR4D Open Engine with heavy-duty clutch, rotating screen, electrical equipment and pre-cleaner.



• Climaxing years of engineering development, this great new engine offers manufacturers and users of power equipment all the advantages of AIR-COOLING, at temperatures from low sub-zero to 140° F., in an exceptionally rugged engine that measures up to any "heavyweight" industrial type liquid-cooled engine, horsepower for horsepower, with many *plus values.*

The outstanding High Torque characteristic of the Model VR4D engine, combined with its extremely rugged construction and heavy-duty stamina, provide *load-lugging holding power,* long life and top power performance.

Advanced "V" design provides an extremely compact power package, plus all traditional Wisconsin heavy-duty features such as tapered roller main bearings.

This new engine rounds out a complete line, comprising 15 models in 4-cycle single cylinder, 2- and 4-cylinder sizes, from 3 to 56 hp. Write for "Spec" Bulletin S-207.

MOST H.P. HOURS

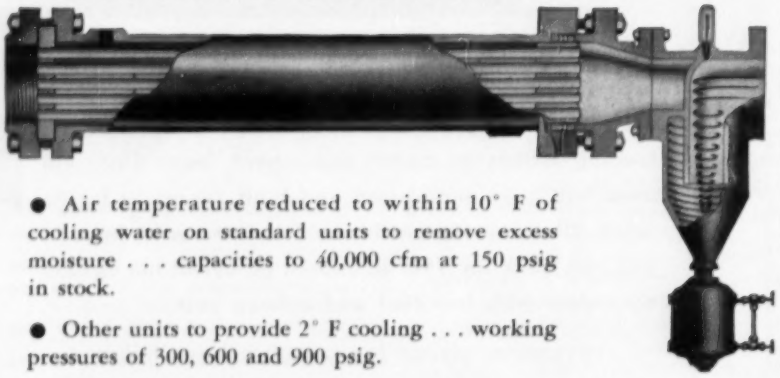
WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

Circle 15A on reply card

DRIER COMPRESSED AIR
with Adams Aftercoolers



• Air temperature reduced to within 10° F of cooling water on standard units to remove excess moisture . . . capacities to 40,000 cfm at 150 psig in stock.

• Other units to provide 2° F cooling . . . working pressures of 300, 600 and 900 psig.

and Cyclone Separators

• Effectively remove condensed moisture entrained in air leaving aftercooler . . . high separating factor over a wide range of flow rates.

• *For full details on Adams Aftercoolers and Cyclone Separators, request Bulletin 711.*

R. P. Adams Co., Inc.

209 East Park Drive, Buffalo 17, New York

Circle 16A on reply card

and a section is devoted to case histories of investment cast parts. Still another is devoted to the Institute's metal specifications and test-bar standards. The publication contains more than 70 illustrations, including several dozen engineering drawings. Orders may be placed with the Investment Casting Institute, 27 East Monroe Street, Chicago 3, Ill. Price, $5.00.

Trent Tube Company, East Troy, Wis., a subsidiary of Crucible Steel Company of America has published a 48-page product catalogue for engineers, purchasing agents and users of stainless steel and high-alloy pipe and tubing. It describes products ranging in size from 1.8 to 40 inches in outside diameter. The story of contour Trentweld is given in a brief introduction. Based on a special patented welding process, it provides industry with what is said to be true uniformity in welded pipe and tubing, plus complete absence of weld bead or undercut. Separate sections describe pipe and tubing for use in high-pressure applications, aircraft, heat-resistant tubing, beverage and dairy equipment, ornamental work, mechanical equipment and shaped and formed tubing. Another is devoted to titanium tubing. Supplementing this are seventeen hardness, conversion, size-range, corrosion, gauge and similar tables, as well as a glossary of tubing terms and helpful facts to aid customers in selecting the proper material. Copies may be obtained by sending requests on company letterhead.

Bulletin No. 270 about "quick-connect, quick-disconnect" HK couplings is available from Snap-Tite, Inc. The unit uses Teflon seals throughout and will reportedly handle acids, alkalies, solvents and high-pressure steam. The coupling will function between 100° and 500°F and can be subjected to lower or higher temperatures for short periods.

Circle 20E on reply card

An improved pneumatic conveying system for rapid car unloading has been announced in Brochure No. 124, published by Sprout, Waldron & Company, Inc. Operating on a vacuum principle, the centrifugal fan is located on the opposite side of the collector from the material conveying line. Thus, the product does not pass through the fan.

Circle 21E on reply card

Van der Horst Corporation has issued a bulletin that describes the uses and properties of Vanderloy, an electronic iron. The substance—99.9-percent pure iron—has such wide industrial applications as rebuilding worn machine parts, giving non-magnetic metals a magnetic surface, salvaging mis-machined parts, and the like.

Circle 22E on reply card

Bulletin No. 11 recently published by the Smooth-On Manufacturing Company, describes its A2 series of aluminum-filled epoxy resin compounds. Called Metalset, it is designed for use in aircraft, marine, and metal-working industries and for any repair or maintenance activity requiring a chemically stable, nonshrinking and nonflammable putty with good adhesion to iron, steel, aluminum, wood, glass or ceramics.

Circle 23E on reply card

Pilot-operated poppet-type air control valves, called Nopak-matic, are described in Catalogue No. 105, published by Galland-Henning, Nopak Division. They are available in 2-, 3- and 4-way-operation models, with master (air), single or double solenoid pilot control and for pipe sizes of from ¼ through ¾ inch.

Circle 24E on reply card

For plant maintenance and safety engineers, Printed Cellophane Tape Company is offering a catalogue listing over 500 self-adhesive Vinyl plastic pipe markers. Cutout numbers and letters as well as standard safety slogans are discussed.

Circle 25E on reply card

Data for selection and applications of Quik-Link conveyor screws, trough ends and hangers are detailed in Folder No. 2489, as are "get-over-or-around" examples of how drive-end space problems can be solved. It is published by Link-Belt Company.

Circle 26E on reply card

Catalogue No. 80C100 gives specifications and prices of Fischer & Porter Company's line of Lab-Crest Pyrex glassware. Included in it are aspirator bottles, gas-collecting tubes, Karl Fischer apparatus, separatory funnels, nitrometers, manifolds and stop-cocks.

Circle 27E on reply card

The AmForge Division of American Brake Shoe Company has published an illustrated booklet on the applications of steel forgings. Research, engineering and production facilities for drop, press and upset forgings are also covered.

Circle 28E on reply card

Packaged Air Conditioners, a 20-page catalogue (No. 6125) is available from American Blower Division of American-Standard. Descriptions are given for design features and such operating components as cooling coils and controls.

Circle 29E on reply card

Bailey Meter Company's Brochure No. P99-3 describes features, applications and operating characteristics of its computing relay for pneumatic systems. The unit requires a 30-psig air supply.

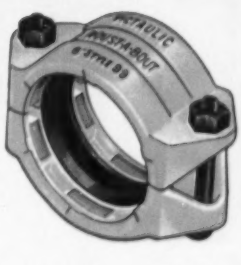
Circle 30E on reply card

VICTAULIC®

METHOD OF PIPING

VICTAULIC HAS EVERYTHING...

VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

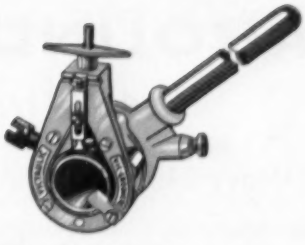


ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99*. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78*. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

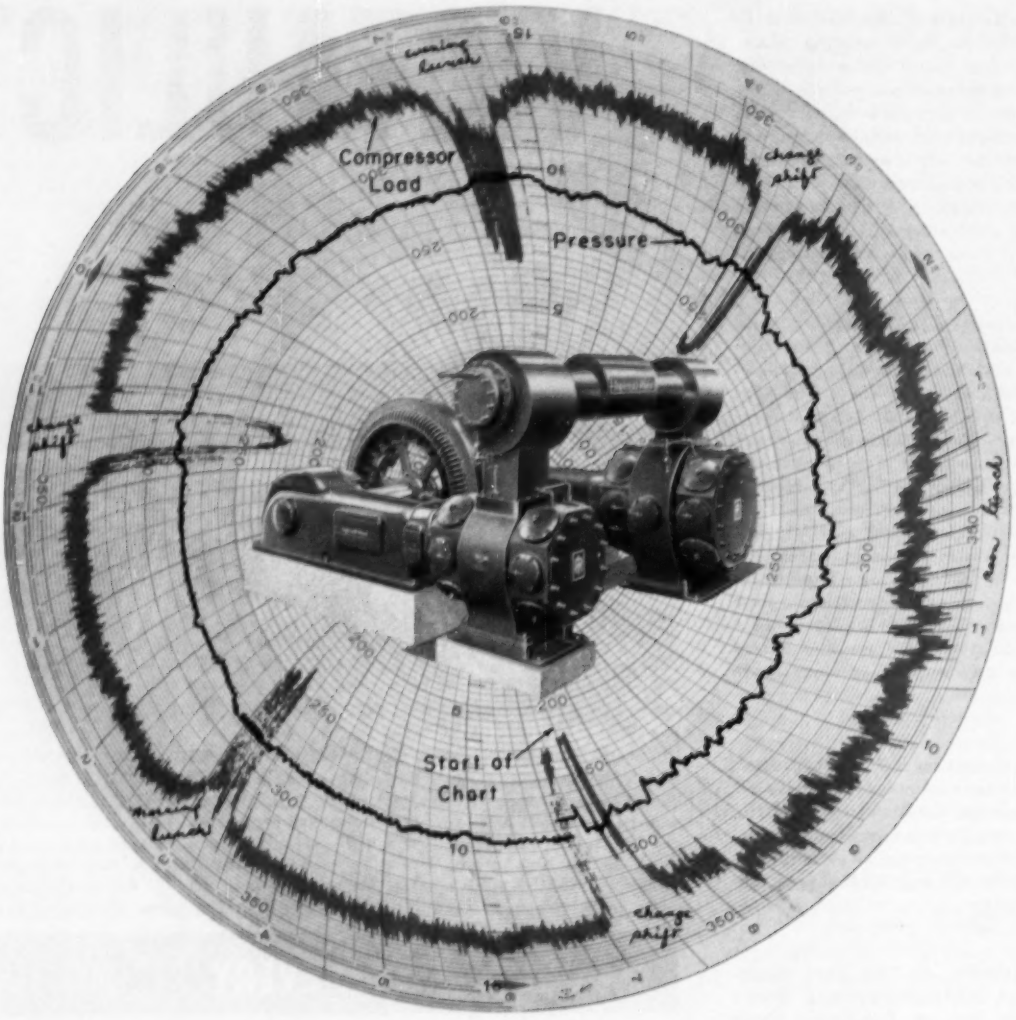
PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. B-7

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Circle 17A on reply card



AROUND THE CLOCK

with an Ingersoll-Rand PRE Compressor

Heavy 24-hour loading like this is all in a day's work at Caterpillar Tractor Co.

An air compressor doesn't punch a time clock. But the 24-hour pressure-capacity chart shown above gives an even better record of its actual, on-the-job performance at Caterpillar Tractor Co., Peoria, Ill.

This chart was taken on a nine-year-old PRE compressor supplying 3330 cfm at 95 psi for general plant air. Except for a slight "breather" during changing of shifts, this heavy-duty compressor is called upon to deliver full rated capacity virtually 24 hours a day — month after month, year after year.

This compressor is one of eight PREs (total capacity 24,640 cfm) in round-the-clock service at the Caterpillar plant. The first PRE unit was installed here in 1927 and, like all the rest, is still giving efficient, dependable performance under full load conditions.

For proved dependability like this, in continuous heavy-duty service, it pays to specify Ingersoll-Rand compressors. Ask your I-R representative to give you the complete story.

PRE compressors, 400 to 3000 hp, use I-R Channel Valves

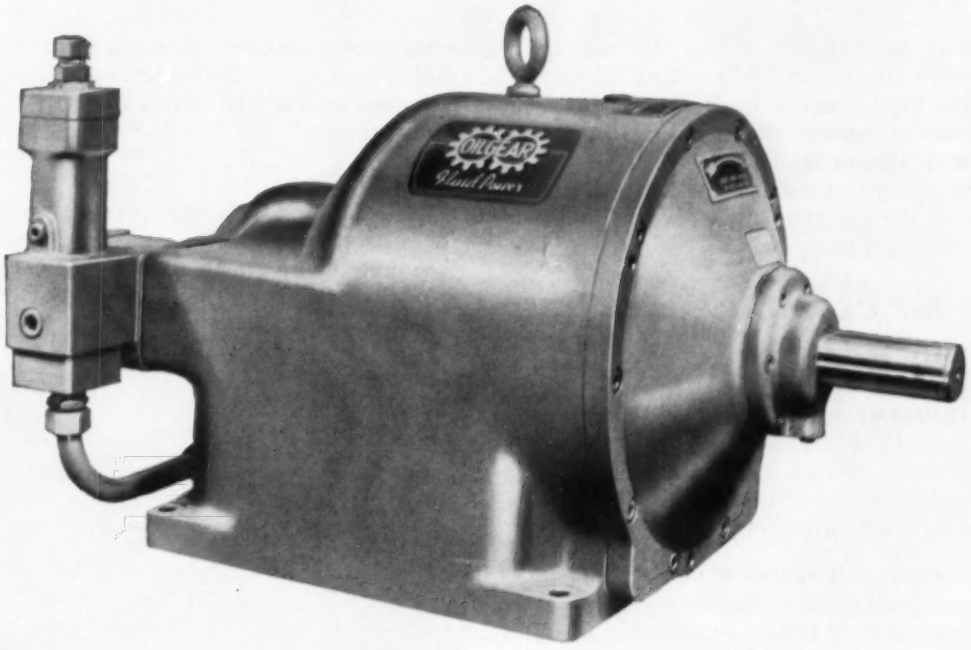
Ingersoll-Rand

1-567

11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS AND DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR AND ELECTRIC TOOLS

Circle 18A on reply card



OILGEAR CONSTANT AND VARIABLE DELIVERY PUMPS. Sturdy, compact units built in sizes having normal ratings from 4 to 150 hp. For over 5 years, Cellulubes kept the durability of these pumps high, even on constant pressure applications.

Where a fire-resistant lubricant is a must—

Celanese Cellulubes give you the plus feature of excellent lubrication . . .

More and more equipment manufacturers and lubrication engineers are learning that fire-resistant Cellulube lubricants provide superior protection against excessive wear during continuous operation under extreme pressures. Tests conducted by The Oilgear Company of Milwaukee, Wisconsin on various fire-resistant fluids showed that Cellulubes "seem to be the most satisfactory fluids for use in Oilgear pumping equipment."

Cellulubes are straight phosphate ester base synthetic oils . . . chemical compounds that contain no additives. Because of this, and because of lower flammability and reduced tendency to form undesirable deposits, Cellulubes can provide excellent lubrication combined with dependable fire protection.

Cellulubes are available for supply in 6 controlled viscosities to meet exacting requirements in the replacement of flammable lubricants presently in use in your plant or equipment. Write for working samples and complete data for a thorough evaluation.

Celanese Corporation of America, Chemical Division, Dept. 596-G, 180 Madison Avenue, New York 16, N. Y.

Celanese® Cellulube®

Celanese CHEMICALS

In Canada: Canadian Chemical Co., Limited, 2035 Guy Street, Montreal, P. Q., Canada
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Circle 19A on reply card

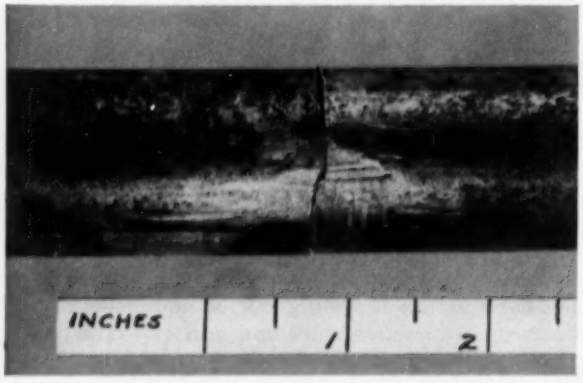
how to get the most out of HOLLOW DRILL RODS

In a modern jackhammer, hollow drill rods must take between 1800 and 2000 jolting blows per minute. It's pretty rugged treatment for *any* steel – even Crucible's special alloy CA DOUBLE DIAMOND or 4E Hollow Drill Rods. That's why it's so important that you prevent unnecessary *abuse* of drill rods on the job. Here are a few tips that may save you time and money.

Take, for example,
DRILLING METHODS

ROD ALIGNMENT – A little extra care in properly aligning the drill rod so that the force of the piston is transmitted to the rock in a straight line will help reduce breakage a surprising amount. For bad alignment sets up severe stresses in the steel.

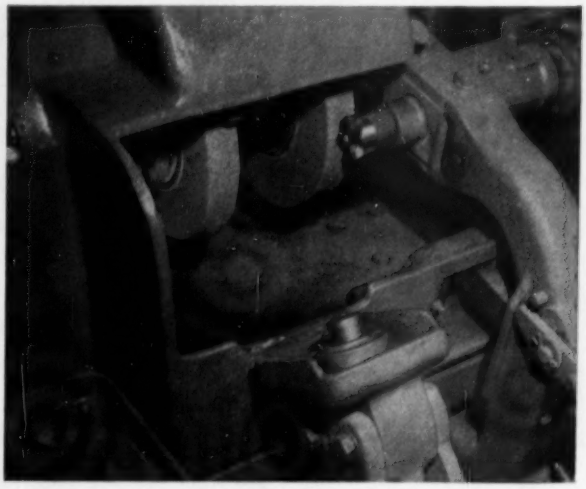
RATE OF FEED – Too slow a rate of feed forces the rod to absorb much of the impact – without a proportionate amount of hole being drilled. Too fast a rate results in a high breakage rate. Alloy rods – Crucible CA DOUBLE DIAMOND or 4E – allow faster drilling speeds than straight carbon drill rods used under the same conditions. That's because these alloy rods have higher hardness, tensile and yield strengths. The harder, more elastic alloy rod transmits the piston blow more efficiently than does the straight carbon drill rod.



Careless handling caused surface damage which resulted in a broken rod.

SURFACE DAMAGE – Damage to the surface of a drill rod may often lead to a broken rod. Nicks or deep tool marks cause stress concentration at the damaged spot.

BITS – Drilling with bits that have dull edges or gages badly worn creates a strain in the drill rod that prevents maximum efficiency. It pays big dividends to keep bits in good shape.



Sharp bits pay off in drilling efficiency.

Actually, the solution to lower drilling costs–longer drill life–is simple: First, use the *right* drill rod and, second, apply a little extra care and common sense to machine setup and operation. It's well worth the effort.

Your nearby Crucible representative can give you helpful hints on other phases of drill rod care and operation–or arrange for *prompt* delivery of hollow drill rods in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

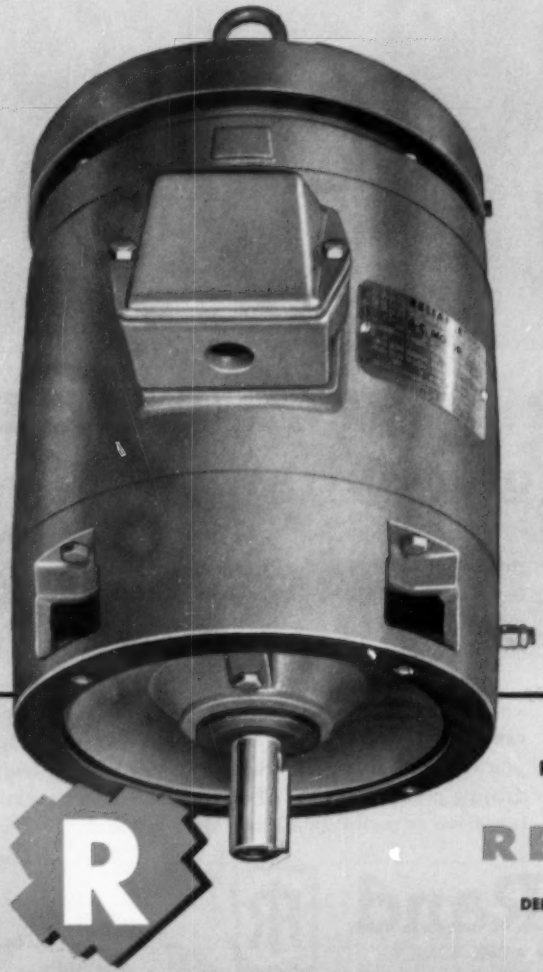
Crucible Steel Company of America

Circle 20A on reply card

NEW RELIANCE P-BASE MOTORS

Designed for outdoor and indoor installations

THESE RELIANCE FEATURES offer you the best motor for your pump installations.



Totally-Protected, weather tight construction—Corrosion-proof cast iron housing and sealed conduit box with threaded inlet locks out water, dust and foreign matter.

Perfect pump seating—True fit machined motor flange mates perfectly with pump flange, eliminating wear from misalignment.

Life long bearing protection—Special oversized thrust bearings designed for vertical operation are protected with Metermatic lubrication; you can't grease 'em wrong.

Shaft sealed—Neoprene shaft slinger protects windings from foreign matter creeping up the shaft.

Enclosures for every application—Protected, totally-enclosed, and explosion-proof, Cl. I Gr. D, Cl. II Grs. E, F, & G enclosures available, 1-30 hp. all electrical characteristics. B-1589

Totally-Enclosed, Corrosion-Proof

Protected

Explosion-Proof
Cl. I, Gr. D
Cl. II, Grs. E, F, & G

Write for bulletin B-2502 and check the facts on why Reliance Totally-Protected P-Base Motors are your best buy.

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 77A, Cleveland 17, Ohio • Canadian Division: Welland, Ontario
Sales Offices and Distributors in Principal Cities

Circle 21A on reply card

THIS DRILLMASTER PERFORMANCE

SOLD FIVE MORE UNITS!

The performance of the Ingersoll-Rand Drillmaster shown above, in the quarry of a large midwest lime producer, has resulted in the sale of five additional units – to other operators who came, saw and were convinced.

This completely self-contained and self-propelled blast hole drilling rig has been in operation for over a year. Using an I-R "down-the-hole" drill and 6½" Ingersoll-Rand Carset Jackbits, sinking 60-ft holes with 18-ft spacing and 24-ft burden, this Drillmaster has consistently maintained a drilling speed of 25 feet of hole per hour, including moving time. Bit life in this dense, hard to drill limestone has exceeded 6,500 ft.

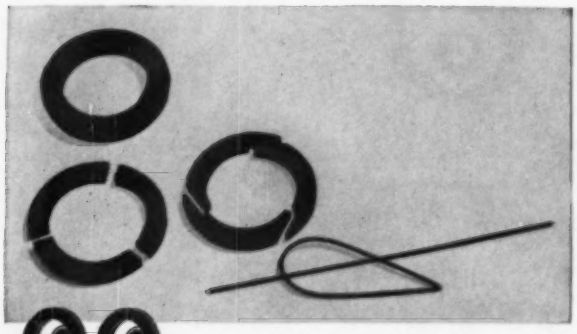
If you're interested in cost-cutting *performance*, see the Drillmaster in action. We will be glad to arrange for a visit to an operating unit – and to help you evaluate its performance in terms of your own drilling conditions. Ask your Ingersoll-Rand representative or write for further details today.

Ingersoll-Rand IR

5-629 11 BROADWAY, NEW YORK 4, N.Y.

THE BEST AIR EQUIPMENT FOR BETTER HIGHWAYS

Circle 22A on reply card



Look to COOK for Better PACKING RINGS!

Whatever your packing-ring requirements, you can depend on Cook for a ring *design* and ring *material* that will deliver maximum efficiency at minimum cost.

One *source*, one high standard of *quality* — that's what you get when you specify Cook — packing-ring pioneers since 1888. Write direct for complete technical data. C. Lee Cook Company, 930 So. 8th St., Louisville 8, Ky.

MATERIALS

GRAPHITIC IRON
(Exclusive with Cook)

COOKMET
(No. 1—Plastic Bronze)
(No. 2—Semi-Plastic Bronze)
(No. 3—Alloy Bronze)

BABBITT
(Highly Anti-Frictional)

COOKROC
(Laminated Bakelite: Standard, Hi-Temp and Graphitized)

CARBON
(For Non-Lubricated Service)

C. LEE COOK COMPANY
Sealing Pressures Since 1888

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47-page catalog illustrating complete line of

ALLEN AIR
AIR CYLINDERS
AIR VALVES & CLAMPS
DIAL FEED TABLES

The cylinder of "distinction" shown above is a Factory Reject. Only straight rods available.

THE A. K. ALLEN CO. 57 Masorole Ave., Brooklyn 33, N. Y. CA-7

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Company _____

Address _____

City _____ Zone _____ State _____

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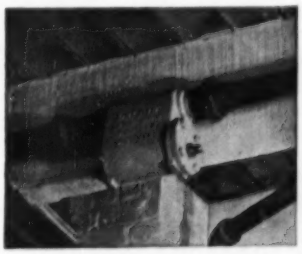
DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper — resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

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don't lose your head!

When bearings fail, don't go to pieces... get on the phone and tell an authorized SKF distributor your troubles. He will help you put things back in order, quickly. Every authorized SKF distributor carries a complete line of SKF ball and roller bearings and pillow blocks — a type for every use — and he is factory-trained by SKF to assist you on any knotty production problems.

Call him for prompt, reliable service on all bearing requirements.

7788

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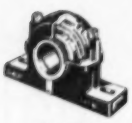
SERIES SY

SERIES FY FLANGED MOUNTING

SERIES SUS

SERIES FUS FLANGED MOUNTING



SERIES SAF

SELF-ALIGNING BALL BEARING

SINGLE ROW DEEP GROOVE

ANGULAR CONTACT BALL BEARING

DOUBLE ROW DEEP GROOVE

SPHERICAL ROLLER BEARING

CYLINDRICAL ROLLER BEARING

SPHERICAL ROLLER THRUST BEARING

TAPERED ROLLER BEARING ("Tyson")

SERIES SDAF

SKF®

BEARING REPLACEMENT SERVICE

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*Reg. U.S. Pat. Off. Tyson Bearing Corporation

Circle 26A on reply card

They look like twins... but one is synchronous

Louis Allis "SYNCRO-*SPEDE*"* offers... for the first time... a synchronous motor in the same frame sizes as a standard induction motor

New from Louis Allis — *the most compact and efficient synchronous induction motor on the market* . . . the revolutionary "Syncro-Spede." It's the *only* synchronous motor built in standard NEMA frames for comparable ratings in any enclosure.

The space-saving "Syncro-Spede" has no external excitation, wound rotating fields, collector rings or brushes—offers simplified control and low-cost operation. And it's virtually maintenance-free.

In performance, "Syncro-Spede" delivers and maintains exact synchronous speed within its rated capacity, regardless of load variations or voltage dips. When "Syncro-Spede" motors of several different ratings are powered by a single adjustable-frequency source, their acceleration, running speed, and deceleration can be synchronized.

"Syncro-Spede" is the low-cost answer to such demanding synchronous applications as *precise adjustable-frequency multi-motor systems* . . . high-frequency generator drives and constant-speed conveyor drives . . . precision timing and metering devices . . . recording instrument drives . . . any system requiring constant speeds from no-load to full-load.

"Syncro-Spede" sizes range up to 100 hp. For information and expert application engineering assistance, contact your nearby Louis Allis District Office or write directly to The Louis Allis Company, 437 East Stewart Street, Milwaukee 1, Wisconsin.

*"Syncro-Spede" is a trademark of the Louis Allis Co.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

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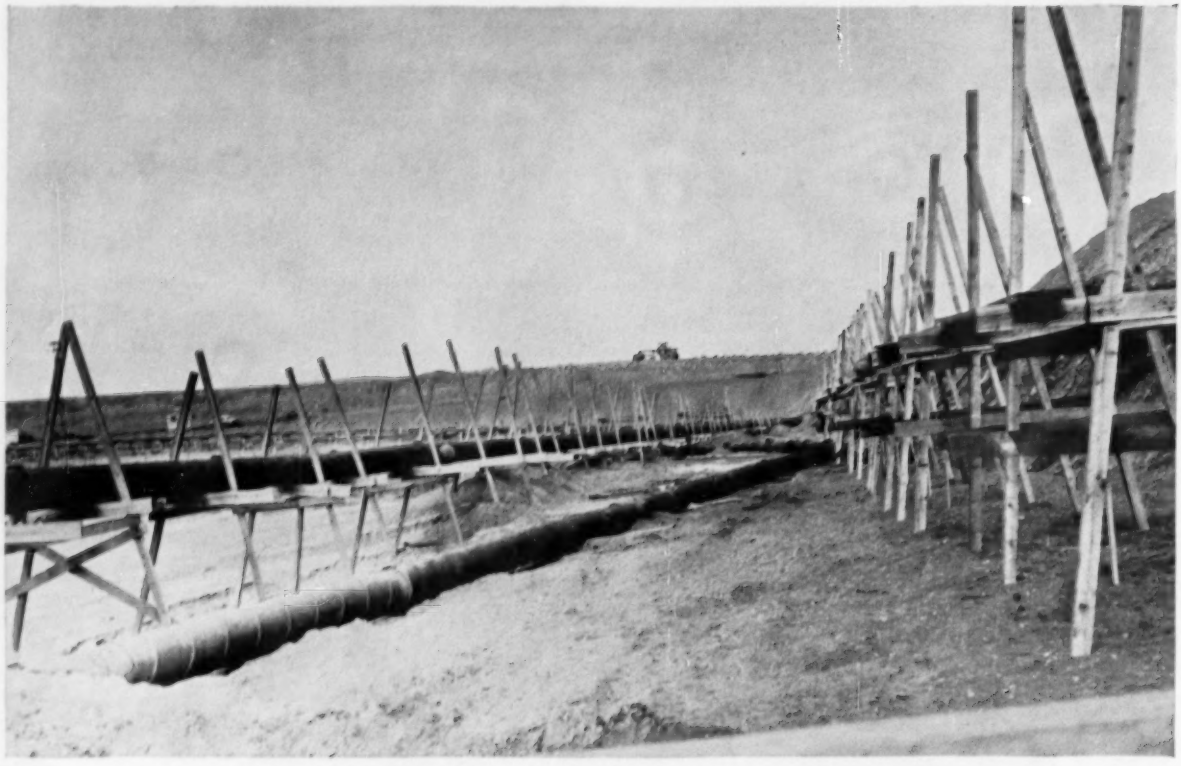
HAULS AND DELIVERS FILL



...Wherever You Want It!

When the job calls for hydraulic placement, you can depend on Naylor Spiralweld for the piping layout that will do the job—faster and at lower cost.

Naylor's exclusive spiral-lock structure creates the one lightweight pipe with the strength and safety required for the rough treatment involved in this service.

Its light weight simplifies handling. Installation is faster, too, with the one-piece Naylor Wedgelock coupling to speed connections. Lines can be knocked down, moved, and re-assembled in minimum time when you use this Naylor pipe and coupling combination.

For full details, write for Bulletins No. 507 on pipe and No. 513 on Wedgelock couplings.

NAYLOR

NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office:
60 East 42nd Street, New York 17, N. Y.

EXPLOSIVES RESEARCH PAYS OFF

Excellent breakage of iron ore from primary blasts assures speedy, economical loading operations.

An uninterrupted cycle of production in a mine begins with the selection and use of the right explosives and blasting method.

A continuous research and development program at Hercules makes explosives available for all kinds and conditions of work . . . in mines and quarries, on heavy-construction jobs, on seismic exploration projects.

Hercules sales engineers welcome the opportunity to consult with you on your explosives and blasting requirements and to assist in finding satisfactory solutions to your problems.

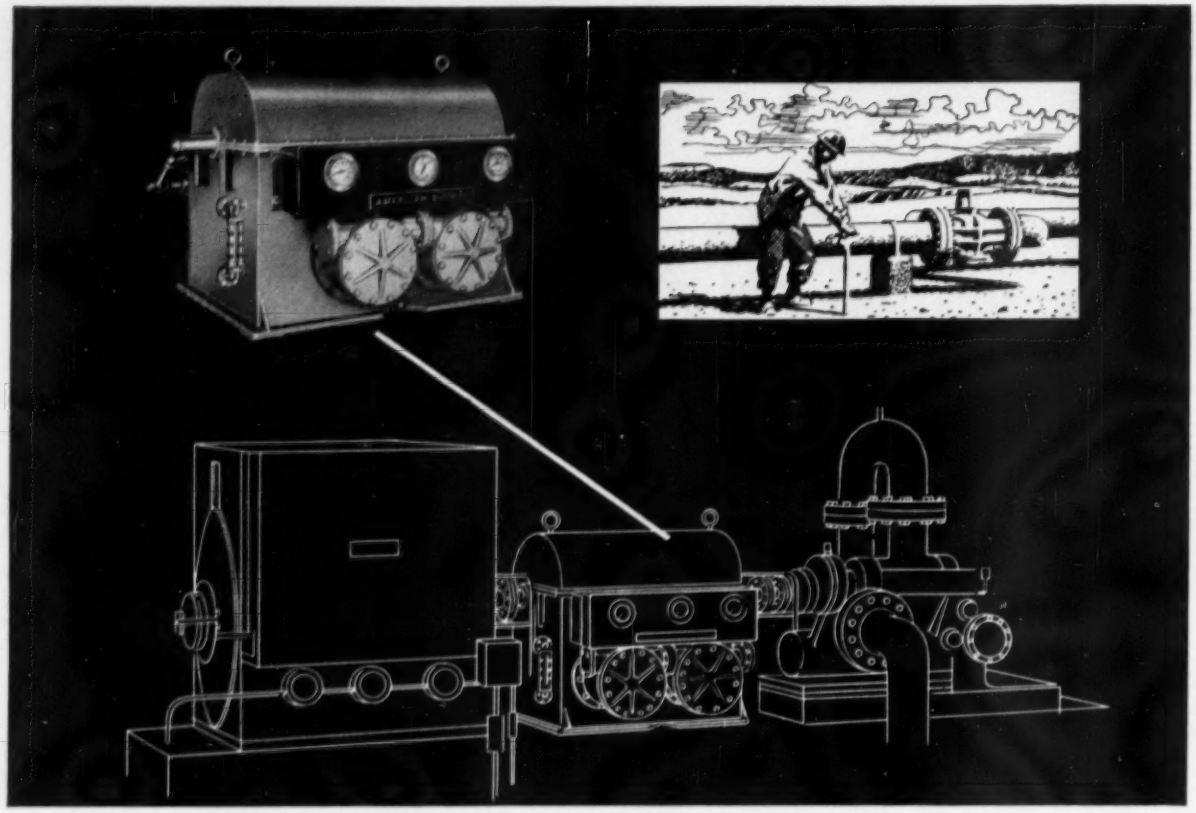
HERCULES

HERCULES POWDER COMPANY
INCORPORATED
Explosives Department, 932 King St., Wilmington 99, Del.

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Cal.; New York, N.Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Cal.

XDST-1

AMERICAN BLOWER *Gyrol*® FLUID DRIVE...



Class 6 Type VS Gyrol Fluid Drive, 250 hp to 12,000 hp, speeds to 3,600 rpm.

How to get more through-put per kw consumed at pipeline pumping stations

You save power dollars in pipeline pumping stations with American Blower Gyrol Fluid Drives. Used with standard, single-speed induction motors, the stepless, adjustable-speed Gyrol units control pump flow and pressure to give the desired output at the lowest power consumption.

For many years, the dependable Gyrol Fluid Drive has satisfied the automation requirements of the power plant industry for driving centrifugal boiler-feed pumps and fans. Now, the same reliable Gyrol Fluid Drive is providing the ideal means of remote-controlled power transmission for the centrifugal pumps in unattended pipeline pumping stations.

Whether you're pumping a single product or multiple products of various densities, here's how you benefit with the Gyrol Fluid Drive:

- Lower demand charges
- Power savings by adjustable pump speed
- No-load motor starting
- Wide range of pump control, permitting complete flexibility whether one or several products are being pumped
- The use of standard induction motors and Gyrol Fluid Drive to provide a safe, dependable power combination

Call your American Blower branch office for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

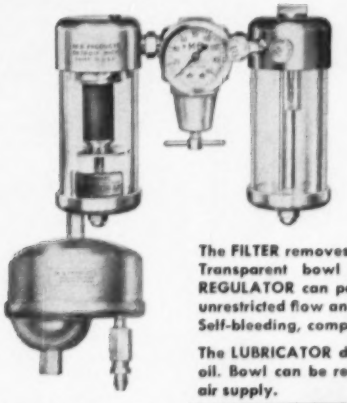
Division of AMERICAN-Standard

Circle 30A on reply card

GREATER PROTECTION to your AIR LINE!

M-B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M·B PRODUCTS
46 VICTOR AVE., Div. 14
DETROIT 3, MICHIGAN

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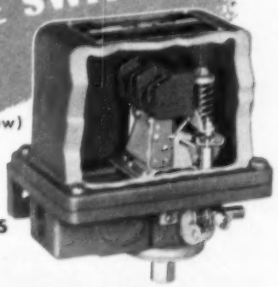
EXPLOSION-RESISTING PRESSURE SWITCH

(cutaway view)



FOR AIR COMPRESSORS AND PUMPS USED IN HAZARDOUS LOCATIONS

THESE FEATURES ADD UP TO A BETTER SWITCH:

- 200 lb. range and usual differential for air compressors and pumps
- Tamper-proof adjustment
- "Power-house" over-center spring fixed for positive action regardless of switch adjustment
- Externally mounted release valve protects against corrosion of internal parts

Also available in WATER-TIGHT construction

Write for Bulletin 9013-G.
Address Square D Company,
4041 N. Richards St., Milwaukee 12, Wis.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

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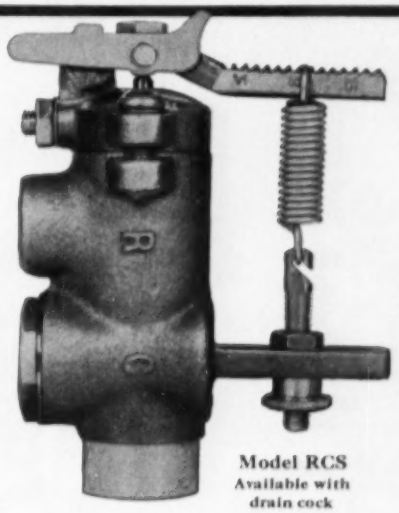
CONRADER UNLOADER VALVES

Positive . . . Accurate . . . Dependable
Time-tested the World Over



Model RCS
Available with drain cock

New Designs—Smaller—More Compact

Positive operation in any position.

Adjustable differentials.

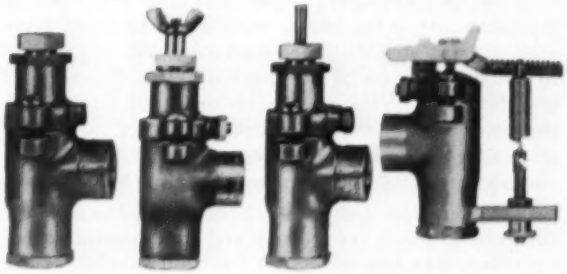
Operating pressures from 4 p.s.i. to 600 p.s.i.

Standard on leading compressors.

Conrader's exchange service trades you a completely rebuilt valve for an old one with new valve guarantee.

One day service on repairs.

Conrader is equipped to custom design special valves in pressures to 1000 p.s.i.



Model RCW | Model RCM-A with hand unloader | Model RCM-A | Model RCF

Distributor Franchises Open

R. CONRADER COMPANY INC.
Box 924, Erie, Pa.

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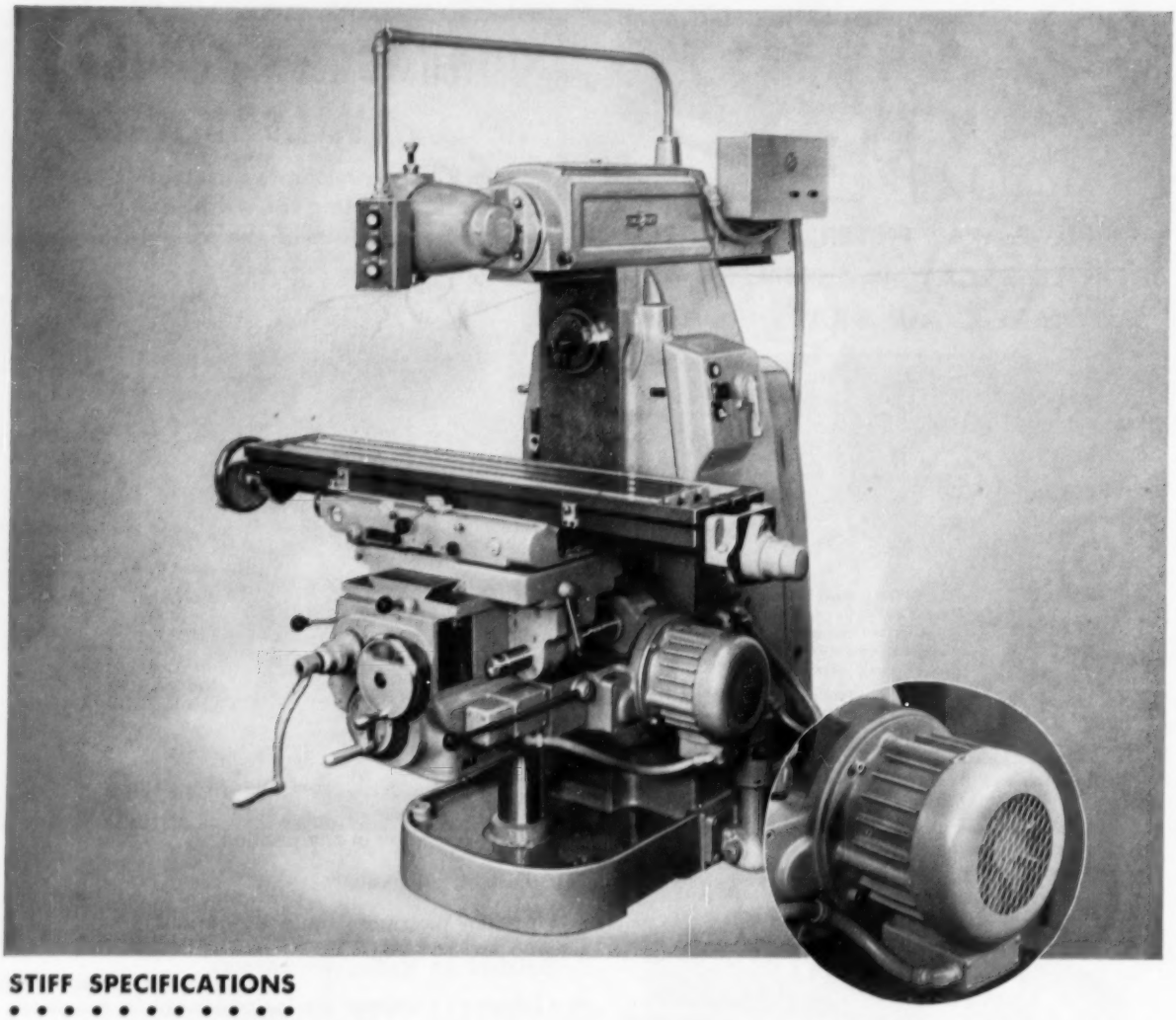

STIFF SPECIFICATIONS

Yet a DIEHL motor met all requirements

The requirements of one of the largest milling machine manufacturers called for a close-coupled, special duty motor to raise and lower the knee and develop sufficient torque for heavy table loads in rapid traverse without stalling. Cool operation was imperative to avoid distortion of the machine table due to heat transfer. The motor was to be mounted directly on the gear case, therefore complete protection against oil leakage into the motor was essential. Motor size, compactness and appearance were important factors. DIEHL developed the special totally enclosed motor illustrated, which met all desired requirements. Cool operation was assured by the fan-cooled design of the motor, effectively preventing heat transfer. The flat-type construction saved considerable space and overhang, conforming well with machine contours. Positive and dependable machine operation was the end result.

This is another example of DIEHL accomplishment based on almost three-quarters of a century of experience in the design and manufacture of motors for industry. Utilize this experience in the solution of your motor problems. We'll work closely with you to provide the right motor — at the right time — at the right price.

DIEHL MANUFACTURING COMPANY
Electrical Division of
THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

Diehl

☐ Please send me Consolidated Motor Catalog and Price List No. CA-7—3540

☐ Please have a DIEHL representative call

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COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

Baltimore • Chamblee, Ga. • Charlotte • Chicago • Cincinnati • Milwaukee • Needham, Mass. • New York • Philadelphia • Syracuse

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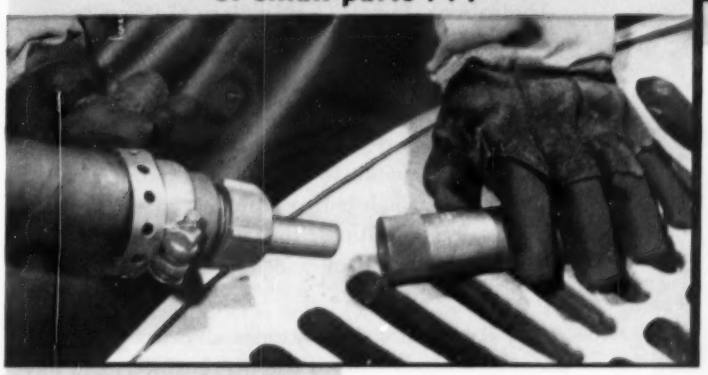
BLAST!

or small parts . . .



More Economically with NORBIDE® Pressure Blast Nozzles

THERE'S a NORBIDE Nozzle available to give you exactly the type of cleaning stream you need–from a broad stream for large areas to a pencil-thin stream for cleaning small openings. And NORBIDE Nozzles –lined with the hardest manufactured material commercially available –maintain stream contour, last longer than any other nozzle made and deliver maximum blasting efficiency at minimum cost per hour.

For full details on cost-cutting NORBIDE Nozzles, write for your free copy of Form 543.

NORTON COMPANY, 41 New Bond St., Worcester 6, Mass.

NORTON®
BORON CARBIDE
Making better products... to make your products better

NORTON PRODUCTS:
Refractories • Abrasives
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NORBIDE . . . *The Longest Nozzle Life You Can Buy*

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Koppers 2-Piece Sealing Rings are installed on hot air shut-off valves manufactured for aircraft by Hydro-Aire, Inc. Ring inners are of stainless steel . . . ring outers are made of high chrome alloy heat resistant cast iron. Diameter is 1¼"

Koppers 2-Piece Rings Solve High Temperature Sealing Problems for Hydro-Aire

A Product of Continuous Research and Development by KOPPERS

To solve a sealing problem at high temperatures, Koppers engineers created a new sealing ring for Hydro-Aire, Inc.

Hydro-Aire, Inc. . . . a subsidiary of Crane Co. . . . manufactures hot air shut-off valves for aircraft applications. Ordinary rubber "O" rings couldn't withstand the high temperatures involved.

Koppers engineers designed a 2-Piece Sealing Ring with extremely close tolerances that provides maximum sealing at high temperatures. Primarily designed for aircraft applications, this new type ring can be used for sealing fuel oil and hydraulic oils as well as hot air and other gases.

The Hydro-Aire application is an interesting example of how highly trained Koppers engineers can solve customers' sealing problems. Koppers engineers in your area will be glad to study your applications and design the proper type of ring.

KOPPERS®

To lower your production costs, bring your ring problems to Koppers. Write to KOPPERS COMPANY, INC., 1607 Hamburg Street, Baltimore 3, Maryland.

RING-TYPE SEALS

Koppers Company, Inc., Metal Products Division
Piston Ring and Seal Department

Engineered* Products Sold with *Service

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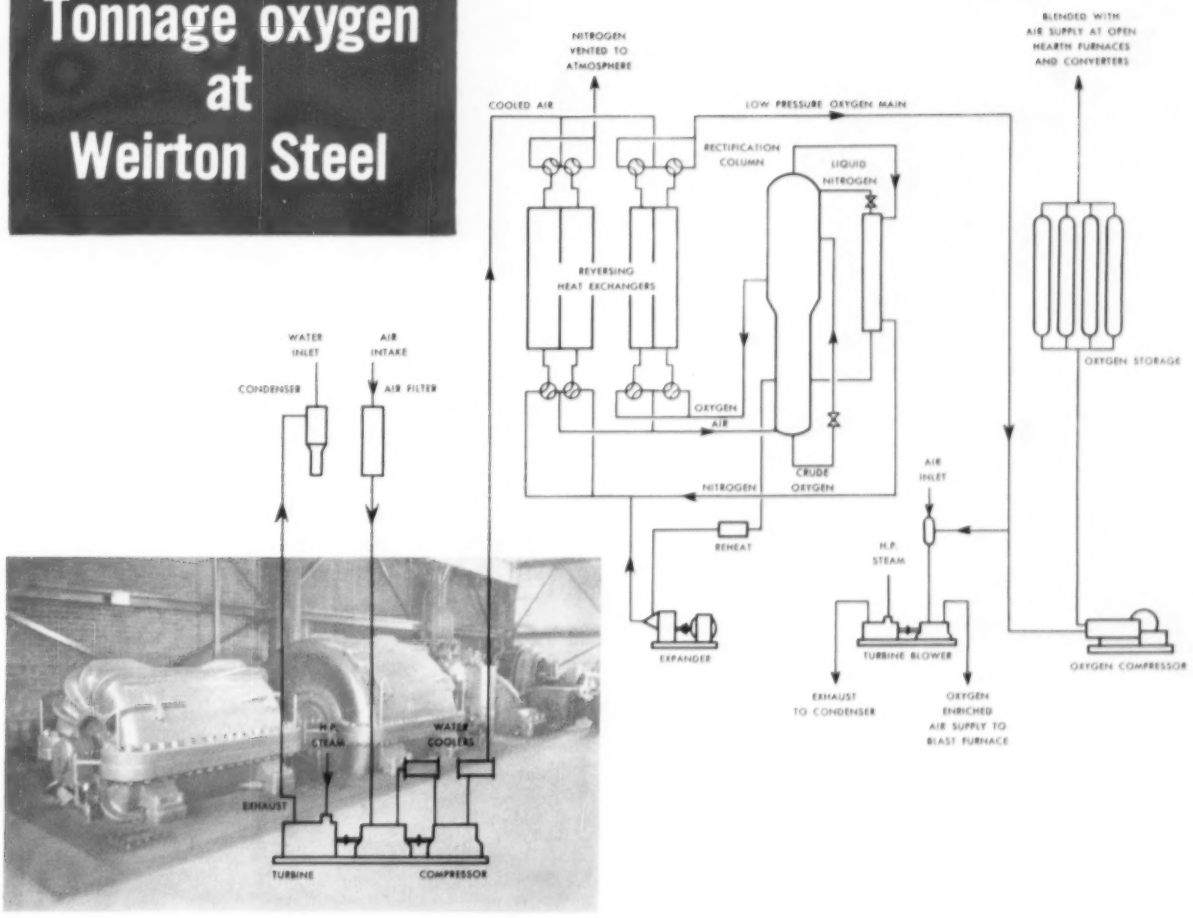
Tonnage oxygen at Weirton Steel



Ingersoll-Rand turbo-compressors cycle air in Weirton's 450-ton per day oxygen plant

"THE Weirton Steel Company Division of the National Steel Corporation started the operation of a tonnage oxygen plant in February 1951, and has operated this plant for the past *six* years making an average daily production of about *460* tons of oxygen for blast furnace and steel plant usage. During this *six*-year period the oxygen plant has produced *750,000* tons of 95 per cent purity oxygen, of which about *650,000* tons have been used for the enrichment of the blast for blast furnace iron production."

Julius H. Strassburger, Assistant Vice President, National Steel Corporation.

For the main air blower in this oxygen plant, which was designed and built by Air Products, Inc., an Ingersoll-Rand tandem turbo-compressor was selected. Pictured above is the high-pressure end of the compressor arrangement. The low-pressure unit delivers air at about 35 to 40 psig through a double intercooler to the second unit, where it is further compressed and discharged at pressures from 75- to 90-psig. The two compressors run in series and are driven by an Ingersoll-Rand steam turbine rated at 10,610 bhp at 3300 rpm.

Among the advantages of oxygen enrichment of the blast, according to Mr. Strassburger, are these: increased iron production with less "cost above Materials;" less flue dust per ton of iron; 25 to 50 lbs of coke saved per ton of iron; increased Btu of the top gas due to less nitrogen; no detrimental effect on furnace linings.

If you are interested in more complete details on the use of I-R turbo-compressors in tonnage oxygen production, contact your nearest Ingersoll-Rand engineer.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

12-600

PUMPS • COMPRESSORS • DIESEL ENGINES • AIR & ELECTRIC TOOLS • TURBO BLOWERS • CONDENSERS

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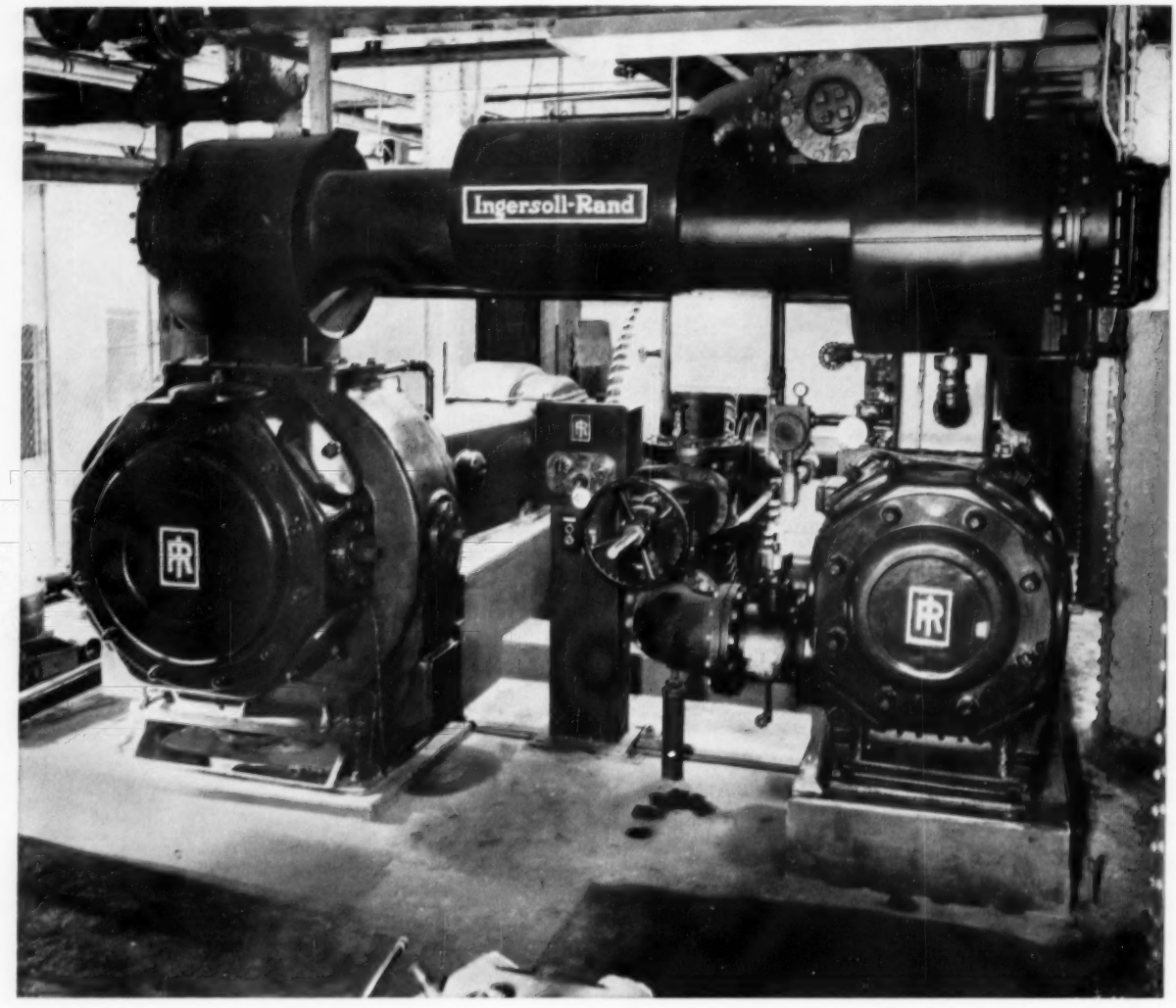

WHAT FACTORS ARE IMPORTANT IN SELECTING A COMPRESSOR OIL?

Size and type of compressor, number of stages or pressure involved, operating conditions—all are important in choosing the right compressor lubricant.

With these factors in mind, there is a *Texaco Regal Oil R&O* exactly right to keep your air compressors free from rust and harmful deposits, keep rings, valves and lines clean, and maintain high over-all compressor efficiency.

You'll find the right one in the complete line of *Texaco Regal Oils R&O*. A Texaco Lubrication Engineer will be glad to help you select the one best for your compressors.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States—or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

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